Transport Canada Transports Canada

TP 6197E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 527 – NORMAL CATEGORY ROTORCRAFT

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa (Ontario)
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51-15/527-2009E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2009-1 (2009/06/30)	2012/03/06	
2009-2 (2009/12/01)	" "	
2012-1 (2012/03/27)	2012/03/06	

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL CHAPTER 527 - NORMAL CATEGORY ROTORCRAFT

Table of Contents

Preamble

General

The content of this chapter is based on the *United States Code of Federal Regulations*, Title 14, Chapter 1, Part 27 entitled, *Airworthiness Standards, Normal Category Rotorcraft*. These United States airworthiness standards have been used and adapted as the model for the Canadian standards supplemented by additional airworthiness requirements based on Canadian experience and required for Canadian aviation purposes.

The FAR numbering system is used. The Canadian standards bears the same number as the FAR equivalent, prefixed by the number "5", as this chapter contains the standards for Part V of the *Canadian Aviation Regulations* (CARs).

* * * * * * * * * * * *

First Edition **Effective: July 1, 1986**

The Standards in this chapter are presented in a two column format with the United States FAR in the left column and the Canadian standards in the right column. Chapters, subchapters, sections and subsections numbering and headings are opposite to the equivalent FAR. Where the Canadian standard is identical to the FAR, the words "No Variation" appear; where a variation exits, the affected part of text is printed opposite to the FAR with all changes underlined.

The first issue of this chapter is based on FAR part 27, up to and including amendment 27-21. In addition to administrative changes (e.g., Administrator = Minister; part = Chapter) and the deletion of references to operating FARs, the Canadian variations included in this edition are as follows:

* Rotorcraft Operations after Ground Cold Soak, section 527.1301-1.

* Miscellaneous Markings and Placards, use of metric units, section 527.1557, paragraph (c)(3).

* Rotorcraft Flight Manual, section 527.1581, use of metric units, paragraph (e), and reference to operating rules, paragraph (f).

* Operating Limitations, Ambient temperature, section 527.1583, paragraph (h).

In addition, the following Airworthiness Manual Advisories (AMA) are attached to this chapter:

* AMA 500C/1 Aircraft or Equipment Incorporating Digital Computer Technology, dated 1 May 1986.

* AMA 500C/2 Multipurpose Electronic Flight Deck Display Systems, dated 1 May 1986.

* AMA 500C/3 Fire Protection - Ignition Sources, dated 1 May 1986.

* AMA 500C/4 Portable Fire Extinguishers for Use in Aircraft, dated 25 March 1986.

* * * * * * * * * * * *

Change 527-1 **Effective: January 1, 1989**

This change incorporates Amendments 27-22 and 27-23 to the *United States Code of Federal Regulations*, Title 14, Chapter 1, Part 27:

* Amendment 27-22 "Cockpit Voice Recorders and Flight Recorders" provides standards governing the design and installation of cockpit voice recorders and flight data recorders for rotorcraft. Generally the requirements and parameters for flight data recorders are upgraded to the level of the most sophisticated systems available; the use of digital recording equipment will henceforth be standard. Additionally, uninterrupted sound recording will be required in cockpit voice recorders. At the date of effectivity of this amendment, Air Navigation Order, Series II, Nos. 13 and 14, do not require cockpit voice recorders or flight data recorders in rotorcraft. The standards in Sections 527.1457 and 527.1459 will not be applicable unless specifically required in the type approval basis, a unique operational requirement, or voluntary compliance is requested and approved by Transport Canada.

* Amendment 27-23 "Rotorcraft Regulatory Review Program; Amendment No. 3" adopts new and revised airworthiness standards for the powerplant and rotor drive systems to respond to changing rotorcraft certification requirements brought on by technological advances. Amendment 27-23 is adopted with the exception of the amendment of 527.1093 subparagraph (b)(1). A variation is presently being developed to require all rotorcraft to demonstrate some capability to operate during flight encounters with snow, without adverse effect on engine operation. Pending approval of this variation, the present text of 527.1093 (b)(1) is reprinted on the right side of the page.

Information Note:

Changes are identified by brackets ; editorial alterations and typographical corrections are not identified.

* * * * * * * * * * * *

Change 527-2 **Effective: February 1, 1992**

This change incorporates the following amendments to the *United States Code of Federal Regulations*, Title 14, Chapter 1, Part 27:

* Amendment 27-24 "Revision of General Operating Flight Rules". This amendment changes a cross-reference to Part 91 in Appendix A of Part 27, therefore it is not applicable in Canada. This FAR change is part of a larger reorganization of the general U.S. operating and flight rules to make them more understandable and easier to use.

* Amendment 27-25 "Occupant Restraint in Normal and Transport Category Rotorcraft". This amendment adds two dynamic crash impact design conditions for seat and occupant restraint systems and increases the static design load factors for seating devices and items of mass in the cabin or adjacent to the cabin. This amendment also prescribes a shoulder harness for each occupant and adopts human impact injury criteria as a measure for occupant protection for dynamic crash impact conditions.

* Amendment 27-26 "Rotorcraft Regulatory Review Program Amendment No. 4". This amendment introduces new and revised airworthiness standards for certification of airframe

and related equipment on both normal and transport category rotorcraft. This amendment resulted from a rotorcraft regulatory review program and the recognition by both the U.S. government and industry that updated safety standards were needed. The amendment provides a high level of safety in design requirements, while removing certain unnecessary existing burdens.

* Amendment 27-27 "Rotorcraft Airworthiness Amendments Based on European Joint Airworthiness Requirements Proposals". This amendment introduces changes to the airworthiness standards for systems propulsion and airframe for both normal and transport category rotorcraft. In addition, the amendment introduces safety improvements, clarifies existing regulations, and standardizes terminology. The changes are based on some of the proposals that were submitted to the FAA by the European Airworthiness Authorities. The amendment is intended to achieve increased commonality of airworthiness standards among the respective countries. Transport Canada, Civil Aviation shares this objective of international harmonization of airworthiness standards for the certification of civil aircraft.

* Amendment 27-28 "Shoulder Harnesses in Normal and Transport Category Rotorcraft". This amendment requires the installation and use of shoulder harnesses at all seats of rotorcraft manufactured after September 1992. In the right column, a Note states that the applicable Canadian retroactive requirements are being published in Air Navigation Order, Series II, No. 2.

In addition, this change introduces:

* A Canadian variation to section 527.1093 subparagraph (b)(1). In the Preamble to Change 527-1, it was annotated against FAR amendment 27-23, that the change in requirements for flight tests in snow conditions was not applicable in Canada and that a new requirement was under development. The variation published in this Change has been subjected to consultation with Canadian aviation industry and has received general acceptance. This variation is supplemented by the publication of advisory material AMA 500C/7, which provides guidance on acceptable means of compliance.

* The revision of previous preambles for completeness and clarity.

* The publication of the following advisory material:

* AMA 500C/5B Aircraft Operation After Ground Cold Soak, dated March 2, 1990.

* AMA 500C/6 Lightning Protection of Aircraft Fuel Systems, dated October 27, 1989.

* AMA 500C/7 Induction System Snow Protection, dated July 27, 1990

* AMA 500C/8 Composite Aircraft Structures, dated January 8, 1991.

* * * * * * * * * * * *

Change 527-3 **Effective: January 3, 1994**

This change is the result of FAA NPRM 90-24. The proposed amendment entitled "Crash Resistant Fuel Systems in Normal and Transport Category Rotorcraft" intends to improve the survivability from helicopter crashes resulting in post crash fires. In anticipation of the final rule incorporating this amendment into FAR Part 27 and in harmonization with the

JAA, Transport Canada has adopted this proposed amendment. The standards intend to minimize spillage of fuel (and other flammable fluids) near ignition sources, minimize potential ignition sources and improve evacuation time needed for crew and passengers to escape a post crash fire.

The adoption of this rule was object of NPA 93-03.

* * * * * * * * * * * *

SECOND EDITION

Change 527-4 **Published: June 1, 2002**

1. General

This change introduces a new format such as the removal of the left-hand column containing the FARs. The Canadian standards in this chapter are now presented in a full-page format. Canadian variations from the FARs are underlined with the FAR text following in a shaded box. The change number and date of affected pages has been removed from the bottom of the page. Instead, affected sections will be followed by change numbers as well as previous change numbers with applicable dates.

With the incorporation of this change, the entire chapter, including all the associated advisory material (AMAs), is republished in a Second Edition.

2. FAR Amendments

This change incorporates the technical standards contained in the following amendments to the *United States Code of Federal Regulations*, Title 14, Chapter 1, Part 27, for which Notices of Proposed Amendments (NPAs) were issued to solicit industry comments on their adoption by reference.

These NPAs were issued under the simplified procedure for the amendment of the design standards of the *Airworthiness Manual*, approved by the Civil Aviation Regulatory Committee on October 15, 1997, and are noted in the following FAR amendment description. It must be noted that FAR amendment effective dates in the *Airworthiness Manual* (AWM) Chapter 527 will differ from the FAR amendment effective dates of the *United States Code of Federal Regulations*, Title 14, Chapter 14, Part 27. Furthermore, AWM Chapter 527 may have, within the text of the requirements, effective dates listed that are different from the effective dates that are listed in the text of the requirements of the *United States Code of Federal Regulations*, Title 14, Chapter 1, Part 27. An information note with the applicable dates underlined in the AWM requirement will be used to highlight any differences.

FAR Amendment 27-29 **Effective: March 25, 1995**

This amendment entitled "New Rotorcraft 30 second/2-minute One Engine Inoperative Power Ratings" adopts new and revised Airworthiness Standards by incorporating optional One-Engine-Inoperative (OEI) power ratings for Multi-engined Turbine-Powered Rotorcraft. These standards enhance rotorcraft safety after an engine failure or shutdown by providing higher OEI power. (NPA 94-14)

FAR Amendment 27-30 **Effective: June 5, 1995**

This amendment entitled "Crash Resistant Fuel Systems in Normal and Transport Category Rotorcraft" adds comprehensive crash resistant fuel system design and test criteria. These new standards will minimize fuel spillage near ignition sources and potential ignition sources, thus reducing the post crash fire hazard to the occupants.

Concurrently with the adoption by reference of this amendment, a Canadian variation to section 527.975 subparagraph (b) was approved to more accurately reflect the tendency of helicopter to rollover during crash landing, by deleting the following phrase:

"unless a rollover is shown to be extremely remote."

The adoption by reference of this amendment, including the Canadian variation, was object of NPA 95-02.

Information Note:

Prior to the adoption of this amendment, Transport Canada adopted FAA NPRM 90-24 and incorporated the proposed rule without the above variation at Change 3 of this Chapter.

Also refer to Amendment 27-35.

FAR Amendment 27-31

Information Note:

Amendment FAR 27-31 "Revision of Authority Citation" was not adopted as it dealt with the recodification of the US Federal Aviation Act of 1958 and is therefore not applicable.

FAR Amendment 27-32 **Effective: April 7, 1997**

This amendment entitled "Occupant Protection in Normal and Transport Category Rotorcraft" which significantly increases the ultimate design load factor for restraining heavy items located above or behind the occupied area during emergency landings. (NPA 96-02)

FAR Amendment 27-33 **Effective: April 7, 1997**

This amendment entitled "Rotorcraft Regulatory Changes Based on European Joint Aviation Requirements" which revises the airworthiness standards for performance, systems, propulsion, and airframes for normal and transport category rotorcraft. In addition, this amendment increases the regulatory safety level, clarifies existing regulations, and standardizes terminology. These changes are based on standards incorporated by the European Joint Aviation Authorities (JAA) for Joint Aviation Requirements (JAR) 27 and 29 and are intended to harmonize airworthiness standards among the respective countries. (NPA 96-03)

FAR Amendment 27-34 **Effective: October 29, 1998**

This technical amendment amends the airworthiness standards for normal and transport category rotorcraft. As published, the final regulations contain some incorrect word usage and omissions, misspellings and incorrect references that may prove to be misleading and are in need of correction. (NPA 1998-175)

FAR Amendment 27-35 **Effective: November 23, 1998**

This amendment entitled "Harmonization of Miscellaneous Rotorcraft Regulations" amends the airworthiness standards to require a cockpit indication of autopilot operating mode to the pilots for certain autopilot configurations, to clarify the burn test requirements for electrical wiring for transport category rotorcraft, and to provide a new requirement for an electrical wire burn test for normal category rotorcraft. The rule also adds a 1.33 fitting factor structural strength requirements to the attachment of litters and berths. (NPA 1998-177)

With amendment 27-35 the FAA also harmonized their requirement of paragraph 27.975 (b) with the Canadian variation 527.975 (b) introduced at amendment 27-35. The text is presently harmonized and the variation does not exist any longer, effective on the date of adoption of this amendment.

FAR Amendment 27-36 **Effective: December 1, 1999**

This amendment entitled "Rotorcraft Load Combination Safety Requirements" revises the airworthiness standards to provide improved safety standards for rotorcraft load combination (RLC) certification. Several accidents occurred in the past 15 years involving the carriage of human external to the rotorcraft. These amendments provide an increased level of safety in the carriage of humans and are harmonized to international standards. Also, these amendments address advances in technology and significant changes in equipment employed in external load operations. (NPA 1999-171)

FAR Amendment 27-37 **Effective: November 23, 1999**

This amendment entitled "Normal Category Rotorcraft Maximum Weight and Passenger Seat Limitation" increases the maximum weight limit from 6,000 to 7,000 pounds, updates the safety standards, and adds a passenger seat limitation of nine. These changes offset the increased weight imposed by additional requirements such as recent requirements to improve occupant survivability in the event of an accident. (NPA 1999-168)

FAR Amendment 27-38

Information Note: *Amendment 27-38, entitled "Critical Parts" is not included in this change issue. Adoption of this amendment by reference is pending.*

FAR Amendment 27-39

Information Note: *Amendment 27-39, "Revision of Authority Citations" adopts new authority citation for Title 14 of the United States Code of Federal Regulations. It does not apply in Canada.*

3. CARAC Working Group

This amendment also implements the recommendations of CARAC Working Group 527-529.

In 1996 the integration of the existing Design Standards of this Manual into the new *Canadian Aviation Regulations* (CARs), Part V was delayed as a result of a request by Canadian aviation industry to review these standards, in particular the Canadian variations,

and all associated Canadian advisory material (AMAs) for their accuracy and appropriateness.

Due to the time-frame for CARs implementation, the CARAC Airworthiness Technical Committee V formed several Working Groups made up of industry and Transport Canada specialists to review those variations, AMAs and any applicable Special Conditions and make recommendations to the Committee for their disposition.

The final report of the 527/529 Working Group was completed in July 1999 and presented to CARAC Technical Committee V in September 1999. All the recommendations were approved by the Civil Aviation Regulatory Committee (CARC) on 10 December 1999. With the publication of this Change to Chapter 527, Transport Canada Civil Aviation, Aircraft Certification Branch, starts the implementation of those recommendations.

Therefore, this change includes:

(a) The amendment to Canadian variation 527.1093 (b)(1)(iii) to correct the terminology, (NPA 2000-99)

(b) The cancellation of Canadian variation 527.1581 (e)(2), (e)(3) and (f). (NPA 2000-100)

(c) The cancellation of Canadian variation 527.975 (b) as explained in the text of amendment 27-35.

(d) The cancellation of Canadian variation 527.1581 (e)(1). (NPA 2001-014)

Information Note:

Section 527.2 (a)(4)(i) is underlined to emphasize the Canadian terminology relating to conformity.

(e) The publication of the following new or revised advisory material:

* AMA 500/7A Induction System Snow Protection, dated 27 January 2000;

* AMA 500/8B Composite Aircraft Structure, dated 8 November 1999;

* AMA 500/9A Standards For The Design And Installation of Aircraft Skis, dated 29 October 1999;

* AMA 500/10 Restricted Category Certification of Small Aeroplanes and Helicopters for Special Purpose Operations, dated 23 August 2001;

* AMA 500/11 Airworthiness Standards For The Design Of Aircraft Floats, dated 2 February 1998;

* AMA 500/12 Carriage of Bulk Liquids in Aircraft, dated 7 April 2000.

(f) The cancellation of the following advisory material:

* AMA 500C/1 Aircraft Or Equipment Incorporating Digital Computer Technology, dated 1 May 1986, superseded by FAA AC 20-115B;

* AMA 500C/2 Multipurpose Electronic Flight Deck Display Systems, dated 1 May 1986;

* AMA 500C/4A Portable Fire Extinguishers for Use in Aircraft, dated 25 March 1987.

4. Miscellaneous Changes

This change also includes editorial corrections, including the update of cross references to CARs (e.g. 527.1).

Due to the consolidation of all regulatory requirements previously found in the *Air Regulations* and *Air Navigation Orders* into the new *Canadian Aviation Regulations*, administrative changes are included in this amendment to update the regulatory references and terminologies (e.g. Type Certificate instead of Type Approval).

Change 527-5 **Effective: December 1, 2004**

In an effort to harmonize our regulatory guidance documents with those of other international aviation authorities and other branches within Transport Canada Civil Aviation (TCCA), the Aircraft Certification Branch has decided to replace existing Airworthiness Manual Advisories (AMA) related to certification of aeronautical products with new Advisory Circulars (AC). While the content of the new ACs will remain technically the same as the corresponding AMAs, which they will replace, the format of the ACs will be standardized to conform to other guidance documents published within the branch.

This change in guidance documentation becomes effective 1 December 2004 at which time the AMAs will be cancelled and replaced by their corresponding Advisory Circular concurrent with the next publishing of the Canadian Aviation Regulations (CAR). After this time, the CARAC Secretariat will no longer publish these AMAs and, consequently, ACs will not be published with their corresponding AWM Chapter. As of the 1 December 2004 issue of the CARs, any affected AMA references and content will have been removed. However, the AMA Index found in AMA 500/00 will, for now, continue to exist to provide a cross-reference between the old AMAs and the new ACs.

Change 527-6 **Published: 1 June 2005**

1. General

This change introduces a new amendment format. This new amendment format is now introduced in this chapter of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following changes to the amendment procedures are introduced in this Change 527-6 in the sections amended by the NPA listed further below:

- the preamble will be the focal point regarding the sections affected by this change. The change number will no longer be provided at the end of an amended section. Rather, for the current change only, the amended text will be followed by an amendment tag identifying the coming into force date of the provision. (example: (amended 2003/06/01))

- brackets "" will no longer be used to identify new or revised text. On the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted but followed by an electronic link to the previous version of the modified text. (example: (amended 2003/06/01; previous version))

- the preamble will include tables of change information. These tables will include the Notices of Proposed Amendments (NPA) with the corresponding amended sections.

2. FAR Amendments

This change incorporates the following amendments to the United States Code of Federal Regulations, Title 14, Chapter I, Part 27:

FAR Amendment 27-38 **Effective: 23 June 2003**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2002-064	• 527.602

This amendment revises the airworthiness standards for both normal and transport category rotorcraft. This amendment defines critical parts and requires a critical parts list, with procedures, to control the design, substantiation, manufacture, maintenance, and modification of critical parts.

FAR Amendment 27-39

See information regarding this amendment in Change 527-4 of this preamble.

FAR Amendment 27-40 **Effective: 24 October 2001**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2001-252	• 527.397

This amendment revises technical content that relate to limit pilot forces and torques.

FAR Correction **Effective: 19 November 2003**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2003-253	• 527.613

This amendment entitled "Material Strength Properties and Design Values" rectifies the editorial error that was introduced when the FAA amendment 27-26 was adopted in the AWM.

Change 527-7 **Published: 30 December 2008**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 27:

***Information Note**: There is presently no FAR Amendment 27-41 as this number was skipped in the U.S. 14 CFR part 27.*

FAR Amendment 27-42 **Effective: 30 October 2008**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2008-004	• 527.1317 • Appendix D

This amendment entitled "High-Intensity Radiated Fields (HIRF) Protection for Aircraft Electrical and Electronic Systems" revises the airworthiness standards for Normal Category Rotorcraft. This action is necessary due to the vulnerability of aircraft electrical and electronic systems and the increasing use of high-power radio frequency transmitters. It is intended to create a safer operating environment for civil aviation by protecting aircraft and their electrical and electronic systems from the adverse effects of HIRF.

Change 527-8 **Published: 30 June 2009**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 27:

FAR Amendment 27-43 **Effective: 11 May 2009**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2008-068	• 527.1457 • 527.1459

This amendment entitled "Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Standards" revises the airworthiness standards for Normal Category Rotorcraft. This amendment increases the duration of certain CVR recordings, requires physical separation of the DFDR and CVR, improves the reliability of the power supplies to both the CVR and DFDR, and requires that certain datalink communications received on an aircraft be recorded if datalink communication equipment is installed. This amendment is based on recommendations issued by the National Transportation Safety Board following its investigations of several accidents and incidents. These changes to CVR and DFDR systems are intended to improve the quality and quantity of information recorded and increase the potential for retaining important information needed for accident and incident investigations.

FAR Amendment 27-44 **Effective: 11 May 2009**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2008-070	• 527.25 • 527.49 • 527.51 • 527.71 • 527.73 • 527.75 • 527.79 • 527.87 • 527.143 • 527.173 • 527.175 • 527.177 • 527.903 • 527.1587 • Appendix B

This amendment entitled " Performance and Handling Qualities Requirements for Rotorcraft" provides new and revised airworthiness standards for normal category rotorcraft due to technical advances in design and operational trends in normal category rotorcraft performance and handling qualities. The changes enhance the safety standards for performance and handling qualities to reflect the evolution of rotorcraft capabilities. This amendment harmonizes Transport Canada, U.S. and European airworthiness standards.

Change 527-9 **Published: 1 December 2009**

On December 1, 2009, Part V Subpart 21 of the Canadian Aviation Regulations (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends sections 527.1 and 527.602 to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

Change 527-10 **Published: June 1, 2012**

This change incorporates the following notice of proposed amendment correction to Appendix B.

Chapter 527 **Effective: March 27, 2012**
Correction (Appendix B – Section VIII)
(Equipment, Systems and Installation)

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2010-025	• Appendix B – Section VIII

This NPA clarifies the FAR reference in section VIII of Appendix B of the *Airworthiness Manual.*

Included in this group of amendments is FAR Amendment 27-19, as published in the US Federal Register, Vol. 48, No. 21, dated January 31, 1983 with an effective date of March 2, 1983. This amendment introduced Appendix B to Chapter 527 and 529. However, a reference to the FAR was directly transposed to Chapter 527, Appendix B and needs to be corrected.

The first issue of Chapter 527 of the *Airworthiness Manual* was published July 1, 1986 and was based on FAR Part 27, up to and including amendment 27-21.

PART V - AIRWORTHINESS

(2002/06/01)

AIRWORTHINESS MANUAL CHAPTER 527
NORMAL CATEGORY ROTORCRAFT

SUBCHAPTER A
GENERAL

527.1 *Applicability*

(a) This chapter sets out airworthiness standards for the issue of type certificates, and changes to those type certificates, for normal category rotorcraft with maximum weights of 3,175 kg (7,000 lbs.) or less and nine or less passenger seats.

(b) Each person who, following the requirements set out in CAR Part V, Subpart 11 or 13, applies for such a type certificate or change to a type certificate must show compliance with the applicable requirements of this chapter.

(c) Multi-engine rotorcraft may be type certificated as Category A provided the requirements referenced in Appendix C of this chapter are met.

(Change 527-2 (92-02-01))
(Change 527-4)

527.2 *Special Retroactive Requirements*

(a) For each rotorcraft manufactured after September 16, 1992, each applicant must show that each occupant's seat is equipped with a safety belt and shoulder harness that meets the requirements of paragraphs (a), (b), and (c) of this section.

(1) Each occupant's seat must have a combined safety belt and shoulder harness with a single-point release. Each pilot's combined safety belt and shoulder harness must allow each pilot, when seated with safety belt and shoulder harness fastened, to perform all functions necessary for flight operations. There must be a means to secure belts and harnesses, when not in use, to prevent interference with the operation of the rotorcraft and with rapid egress in an emergency.

(2) Each occupant must be protected from serious head injury by a safety belt plus a shoulder harness that will prevent the head from contacting any injurious object.

(3) The safety belt and shoulder harness must meet the static and dynamic strength requirements, if applicable, specified by the rotorcraft type certification basis.

(4) For purposes of this section, the date of manufacture is either:

(i) The date the statement of conformity or equivalent inspection acceptance records, reflects that the rotorcraft is complete and meets the type design data approved by the Minister; or

(ii) The date the foreign civil airworthiness authority certifies that the rotorcraft is complete and issues an original standard airworthiness certificate, or equivalent, in that country.

(b) For rotorcraft with a certification basis established prior to November 23, 1999:

(1) The maximum passenger seat capacity may be increased to eight or nine provided the applicant shows compliance with all the airworthiness requirements of this chapter in effect on November 23, 1999.

(2) The maximum weight may be increased to greater than 2,720 kg (6,000 lbs.) provided:

(i) The number of passenger seats is not increased above the maximum number certificated on November 23, 1999, or

(ii) The applicant shows compliance with all of the airworthiness requirements of this chapter in effect on November 23, 1999.

Information Note:

The underlined effective dates above are different from the effective dates stated in the same requirements of FAR section 27.2(b). The change in the requirement of section 527.2(b) above is FAR amendment 27-37. Consequently, the difference in dates exists because FAR amendment 27-37 is not effective in Canada until November 23, 1999 as per NPA 1999-168.

(Change 527-2 (92-02-01))

(Change 527-4)

SUBCHAPTER B
FLIGHT- GENERAL

527.21 *Proof of Compliance*

Each requirement of this subchapter must be met at each appropriate combination of weight and centre of gravity within the range of loading conditions for which certification is requested. This must be shown:

(a) By tests upon a rotorcraft of the type for which certification is requested, or by calculations based on, and equal in accuracy to, the results of testing; and

(b) By systematic investigation of each required combination of weight and centre of gravity if compliance cannot be reasonably inferred from combinations investigated.

527.25 *Weight Limits*

(a) Maximum weight. The maximum weight (the highest weight at which compliance with each applicable requirement of this chapter is shown) must be established so that it is:

(1) Not more than:

(i) The highest weight selected by the applicant;

(ii) The design maximum weight (the highest weight at which compliance with each applicable structural loading condition of this chapter is shown);

(iii) The highest weight at which compliance with each applicable flight requirement of this chapter is shown; or
(amended 2009/05/11)

(iv) The highest weight in which the provisions of 527.87 or 527.143(c)(1), or combinations thereof, are demonstrated if the weights and operating conditions (altitude and temperature) prescribed by those requirements cannot be met; and
(amended 2009/05/11)

(2) Not less than the sum of:

(i) The empty weight determined under 527.29;

(ii) The weight of usable fuel appropriate to the intended operation with full payload;

(iii) The weight of full oil capacity; and

(iv) For each seat, an occupant weight of 170 pounds or any lower weight for which certification is requested.

(b) Minimum weight. The minimum weight (the lowest weight at which compliance with each applicable requirement of this chapter is shown) must be established so that it is:

(1) Not more than the sum of:

(i) The empty weight determined under 527.29; and

(ii) The weight of the minimum crew necessary to operate the rotorcraft, assuming for each crew member a weight no more than 170 pounds, or any lower weight selected by the applicant, or included in the loading instructions; and

(2) Not less than:

(i) The lowest weight selected by the applicant;

(ii) The design minimum weight (the lowest weight at which compliance with each applicable structural loading condition of this chapter is shown); or

(iii) The lowest weight at which compliance with each applicable flight requirement of this chapter is shown.

(c) Total weight with jettisonable external load. A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if:

(1) The rotorcraft-load combination does not include human external cargo;

(2) Structural component approval for external load operations under either 527.865 or under equivalent operational standards is obtained;

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load;

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this chapter under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section; and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under 527.865 (a) and (d) of this chapter.

(Change 527-4)

527.27 *Centre of Gravity Limits*

The extreme forward and aft centres of gravity and, where critical, the extreme lateral centres of gravity must be established for each weight established under 527.25. Such an extreme may not lie beyond:

(a) The extremes selected by the applicant;

(b) The extremes within which the structure is proven; or

(c) The extremes within which compliance with the applicable flight requirements is shown.

527.29 *Empty Weight and Corresponding Centre of Gravity*

(a) The empty weight and corresponding centre of gravity must be determined by weighing the rotorcraft without the crew and payload, but with:

(1) Fixed ballast;

(2) Unusable fuel; and

(3) Full operating fluids, including:

(i) Oil;

(ii) Hydraulic fluid; and

(iii) Other fluids required for normal operation of rotorcraft systems, except water intended for injection in the engines.

(b) The condition of the rotorcraft at the time of determining empty weight must be one that is well defined and can be easily repeated, particularly with respect to the weights of fuel, oil, coolant, and installed equipment.

527.31 *Removable Ballast*

Removable ballast may be used in showing compliance with the flight requirements of this subchapter.

527.33 *Main Rotor Speed and Pitch Limits*

(a) Main rotor speed limits. A range of main rotor speeds must be established that:

(1) With power-on, provides adequate margin to accommodate the variations in rotor speed occurring in any appropriate manoeuvre, and is consistent with the kind of governor or synchronizer used; and

(2) With power-off, allows each appropriate autorotative manoeuvre to be performed throughout the ranges of airspeed and weight for which certification is requested.

(b) Normal main rotor high pitch limits (power-on). For rotorcraft, except helicopters required to have a main rotor low speed warning under paragraph (e) of this section, it must be shown, with power-on and without exceeding approved engine maximum limitations, that main rotor speeds substantially less than the minimum approved main rotor speed will not occur under any sustained flight condition. This must be met by:

(1) Appropriate setting of the main rotor high pitch stop;

(2) Inherent rotorcraft characteristics that make unsafe low main rotor speeds unlikely; or

(3) Adequate means to warn the pilot of unsafe main rotor speeds.

(c) Normal main rotor low pitch limits (power-off). It must be shown, with power-off, that:

(1) The normal main rotor low pitch limit provides sufficient rotor speed, if any autorotative condition, under the most critical combinations of weight and airspeed; and

(2) It is possible to prevent over speeding of the rotor without exceptional piloting skill.

(d) Emergency high pitch. If the main rotor high pitch stop is set to meet paragraph (b)(1) of this section, and if that stop cannot be exceeded inadvertently, additional pitch may be made available for emergency use.

(e) Main rotor low speed warning for helicopters. For each single engine helicopter, and each multi-engine helicopter that does not have an approved device that automatically increases power on the operating engines when one engine fails, there must be a main rotor low speed warning which meets the following requirements:

(1) The warning must be furnished to the pilot in all flight conditions, including power-on and power-off flight, when the speed of a main rotor approaches a value that can jeopardize safe flight.

(2) The warning may be furnished either through the inherent aerodynamic qualities of the helicopter or by a device.

(3) The warning must be clear and distinct under all conditions, and must be clearly distinguishable from all other warnings. A visual device that requires the attention of the crew within the cockpit is not acceptable by itself.

(4) If a warning device is used, the device must automatically deactivate and reset when the low-speed condition is corrected. If the device has an audible warning, it must also be equipped with a means for the pilot to manually silence the audible warning before the low-speed condition is corrected.

Performance

527.45 *General*

(a) Unless otherwise prescribed, the performance requirements of this subchapter must be met for still air and a standard atmosphere.

(b) The performance must correspond to the engine power available under the particular ambient atmospheric conditions, the particular flight condition, and the relative humidity specified in paragraphs (d) or (e) of this section, as appropriate.

(c) The available power must correspond to engine power, not exceeding the approved power, less:

(1) Installation losses; and

(2) The power absorbed by the accessories and services appropriate to the particular ambient atmospheric conditions and the particular flight condition.

(d) For reciprocating engine-powered rotorcraft, the performance, as affected by engine power, must be based on a relative humidity of 80 percent in a standard atmosphere.

(e) For turbine engine-powered rotorcraft, the performance, as affected by engine power, must be based on a relative humidity of:

(1) 80 percent, at and below standard temperature; and

(2) 34 percent, at and above standard temperature plus 50° F. Between these two temperatures, the relative humidity must vary linearly.

(f) For turbine-engine-powered rotorcraft, a means must be provided to permit the pilot to determine prior to take-off that each engine is capable of developing the power necessary to achieve the applicable rotorcraft performance prescribed in this subchapter.

527.49 *Performance at Minimum Operating Speed*
(amended 2009/05/11)

(a) For helicopters:
(amended 2009/05/11)

(1) The hovering ceiling must be determined over the ranges of weight, altitude and temperature for which certification is requested, with:
(amended 2009/05/11)

(i) Take-off power;
(amended 2009/05/11)

(ii) The landing gear extended; and
(amended 2009/05/11)

(iii) The helicopter in-ground effect at a height consistent with normal take-off procedures; and
(amended 2009/05/11)

(2) The hovering ceiling determined under paragraph (a)(1) of this section must be at least:
(amended 2009/05/11)

(i) For reciprocating engine powered helicopters, 4,000 feet at maximum weight with a standard atmosphere;
(amended 2009/05/11)

(ii) For turbine engine powered helicopters, 2,500 feet pressure altitude at maximum weight at a temperature of standard plus 22°C (standard plus 40°F).
(amended 2009/05/11)

(3) The out-of-ground effect hovering performance must be determined over the ranges of weight, altitude and temperature for which certification is requested, using take-off power.
(amended 2009/05/11)

(b) For rotorcraft other than helicopters, the steady rate of climb at the minimum operating speed must be determined over the ranges of weight, altitude and temperature for which certification is requested, with:
(amended 2009/05/11)

(1) Take-off power; and
(amended 2009/05/11)

(2) The landing gear extended.
(amended 2009/05/11)

527.51 *Take-off*

The take-off, with take-off power and r.p.m., at the most critical centre of gravity, and with weight from the maximum weight at sea level to the weight for which take-off certification is requested for each altitude covered by this section:
(amended 2009/05/11)

(a) May not require exceptional piloting skill or exceptionally favourable conditions throughout the ranges of altitude from standard sea level conditions to the maximum altitude for which take-off and landing certification is requested, and
(amended 2009/05/11)

(b) Must be made in such a manner that a landing can be made safely at any point along the flight path if an engine fails. This must be demonstrated up to the maximum altitude for which take-off and landing certification is requested or 7,000 feet density altitude, whichever is less.
(amended 2009/05/11)

527.65 *Climb:All Engines Operating*

(a) For rotorcraft other than helicopters:

(1) The steady rate of climb, at V_Y, must be determined:

(i) With maximum continuous power on each engine;

(ii) With the landing gear retracted; and

(iii) For the weights, altitudes, and temperatures for which certification is requested; and

(2) The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either:

(i) At least 1:10 if the horizontal distance required to takeoff and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or

(ii) At least 1:6 under standard sea level conditions;

(b) Each helicopter must meet the following requirements:

(1) V_Y must be determined:

(i) For standard sea level conditions;

(ii) At maximum weight; and

(iii) With maximum continuous power on each engine.

(2) The steady rate of climb must be determined:

(i) At the climb speed selected by the applicant at or below V_{NE};

(ii) Within the range from sea level up to the maximum altitude for which certification is requested;

(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and

(iv) With maximum continuous power on each engine.

(Change 527-4)

527.67 *Climb:One Engine Inoperative*

For multi-engine helicopters, the steady rate of climb (or descent), at V_Y (or at the speed for minimum rate of descent), must be determined with:

(a) Maximum weight;

(b) The critical engine inoperative and the remaining engines at either:

(1) Maximum continuous power and, for helicopters for which certification for the use of 30-minute OEI power is requested, at 30-minute OEI power; or

(2) Continuous OEI power for helicopters for which certification for the use of continuous OEI power is requested.

(Change 527-1 (89-01-01))

527.71 *Autorotation Performance*
(amended 2009/05/11)

For single-engine helicopters and multi-engine helicopters that do not meet the Category A engine isolation requirements of Chapter 529 of this Manual, the minimum rate of descent airspeed and the best angle-of-glide airspeed must be determined in autorotation at:

(a) Maximum weight; and

(b) Rotor speed(s) selected by the applicant.

527.73 *Reserved*
(amended 2009/05/11)

527.75 *Landing*

(a) The rotorcraft must be able to be landed with no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise, or water loop, and without exceptional piloting skill or exceptionally favourable conditions, with:

(1) Approach or autorotation speeds appropriate to the type of rotorcraft and selected by the applicant;
(amended 2009/05/11)

(2) The approach and landing made with:

(i) Power off, for single-engine rotorcraft and entered from steady state autorotation; or
(amended 2009/05/11)

(ii) One-engine inoperative (OEI) for multiengine rotorcraft, with each operating engine within approved operating limitations and entered from an established OEI approach.
(amended 2009/05/11)

527.79 *Reserved*
(amended 2009/05/11)

527.87 *Height-Speed Envelope*
(amended 2009/05/11)

(a) If there is any combination of height and forward speed (including hover) under which a safe landing cannot be made under the applicable power failure condition in paragraph (b) of this section, a limiting height-speed envelope must be established (including all pertinent information) for that condition, throughout the ranges of:
(amended 2009/05/11)

(1) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft, or 7,000 feet density altitude, whichever is less; and
(amended 2009/05/11)

(2) Weight, from the maximum weight at sea level to the weight selected by the applicant for each altitude covered by paragraph (a)(1) of this section. For helicopters, the weight at altitudes above sea level may not be less than the maximum weight or the highest weight allowing hovering out-of-ground effect, whichever is lower.
(amended 2009/05/11)

(b) The applicable power failure conditions are:
(amended 2009/05/11)

(1) For single-engine helicopters, full autorotation;
(amended 2009/05/11)

(2) For multiengine helicopters, OEI (where engine isolation features ensure continued operation of the remaining engines), and the remaining engine(s) within approved limits and at the minimum installed specification power available for the most critical combination of approved ambient temperature and pressure altitude resulting in 7,000 feet density altitude or the maximum altitude capability of the helicopter, whichever is less, and
(amended 2009/05/11)

(3) For other rotorcraft, conditions appropriate to the type.
(amended 2009/05/11)

Flight Characteristics

527.141 *General*

The rotorcraft must:

(a) Except as specifically required in the applicable section, meet the flight characteristics requirements of this subchapter:

(1) At the altitudes and temperatures expected in operation;

(2) Under any critical loading condition within the range of weights and centres of gravity for which certification is requested;

(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and

(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;

(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including:

(1) Sudden failure of one engine, for multi-engine rotorcraft meeting transport Category A engine isolation requirements of Chapter 529 of this Manual;

(2) Sudden, complete power failure, for other rotorcraft; and

(3) Sudden, complete control system failures specified in 527.695 of this chapter; and

(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this chapter.

527.143 *Controllability and Manoeuvrability*

(a) The rotorcraft must be safely controllable and manoeuvrable:

(1) During steady flight; and

(2) During any manoeuvre appropriate to the type including:

(i) Take-off ;

(ii) Climb;

(iii) Level flight;

(iv) Turning flight;

(v) Autorotation;
(amended 2009/05/11)

(vi) Landing (power on and power off); and

(vii) Recovery to power-on flight from a balked autorotative approach.

(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with:

(1) Critical weight;

(2) Critical centre of gravity;

(3) Critical rotor r.p.m.; and

(4) Power off (except for helicopters demonstrating compliance with paragraph (f) of this section) and power-on.

(c) Wind velocities from zero to at least 17 knots, from all azimuths, must be established in which the rotorcraft can be operated without loss of control on or near the ground in any manoeuvre appropriate to the type (such as crosswind take-offs, sideward flight and rearward flight):
(amended 2009/05/11)

(1) With altitude, from standard sea level conditions to the maximum take-off and landing altitude capability of the rotorcraft, or 7,000 feet density altitude, whichever is less, with:
(amended 2009/05/11)

(i) Critical weight;
(amended 2009/05/11)

(ii) Critical centre of gravity; and

(amended 2009/05/11)

(iii) Critical rotor r.p.m.;
(amended 2009/05/11)

(2) For take-off and landing altitudes above 7,000 feet density altitude with:
(amended 2009/05/11)

(i) Weight selected by the applicant;
(amended 2009/05/11)

(ii) Critical centre of gravity; and
(amended 2009/05/11)

(iii) Critical rotor r.p.m.
(amended 2009/05/11)

(d) Wind velocities from zero to at least 17 knots, from all azimuths, must be established in which the rotorcraft can be operated without loss of control out-of-ground-effect, with:
(amended 2009/05/11)

(1) Weight selected by the applicant;
(amended 2009/05/11)

(2) Critical centre of gravity;
(amended 2009/05/11)

(3) Rotor r.p.m. selected by the applicant; and
(amended 2009/05/11)

(4) Altitude, from standard sea level conditions to the maximum take-off and landing altitude capability of the rotorcraft.
(amended 2009/05/11)

(e) The rotorcraft, after:

(1) Failure of one engine in the case of multi-engine rotorcraft that meet transport Category A engine isolation requirements, or

(2) Complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than:

(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and

(ii) For any other condition, normal pilot reaction time.

(f) For helicopters for which a V_{NE} (power-off) is established under 527.1505 (c), compliance must be demonstrated with the following requirements with critical weight, critical centre of gravity and critical rotor r.p.m.:

(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.

(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

527.151 *Flight Controls*

(a) Longitudinal, lateral, directional, and collective controls may not exhibit excessive breakout force, friction, or preload.

(b) Control system forces and free play may not inhibit a smooth, direct rotorcraft response to control system input.

527.161 *Trim Control*

The trim control:

(a) Must trim any steady longitudinal, lateral, and collective control forces to zero in level flight at any appropriate speed; and

(b) May not introduce any undesirable discontinuities in control force gradients.

527.171 *Stability:General*

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal manoeuvre for a period of time as long as that expected in normal operation. At least three landings and take-offs must be made during this demonstration.

527.173 *Static Longitudinal Stability*

(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain an airspeed less than the trim speed, and a forward movement of the control is necessary to obtain an airspeed more than the trim speed.
(amended 2009/05/11)

(b) Throughout the full range of altitude for which certification is required, with the throttle and collective pitch held constant during the manoeuvres specified in 527.175 (a) through (d), the slope of the control position versus airspeed curve must be positive. However, in limited flight conditions or modes of operation determined by the Minister to be acceptable, the slope of the control position versus airspeed curve may be neutral or negative if the rotorcraft possesses flight characteristics that allow the pilot to maintain airspeed within ±5 knots of the desired trim airspeed without exceptional piloting skill or alertness.
(amended 2009/05/11)

527.175 *Demonstration of Static Longitudinal Stability*

(a) Climb. Static longitudinal stability must be shown in the climb condition at speeds from V_Y–10 kt to V_Y+10 kt with:
(amended 2009/05/11)

(1) Critical weight;

(2) Critical centre of gravity;

(3) Maximum continuous power;

(4) The landing gear retracted; and

(5) The rotorcraft trimmed at V_Y.

(b) Cruise. Static longitudinal stability must be shown in the cruise condition at speeds from 0.8 V_{NE} –10 kt to 0.8 V_{NE} +10 kt or, if V_H is less than 0.8 V_{NE}, from V_H –10 kt to V_H +10 kt, with:
(amended 2009/05/11)

(1) Critical weight;

(2) Critical centre of gravity;

(3) Power for level flight at 0.8 V_{NE} or V_H, whichever is less;
(amended 2009/05/11)

(4) The landing gear retracted; and

(5) The rotorcraft trimmed at 0.8 V_{NE} or V_H, whichever is less.
(amended 2009/05/11)

(c) V_{NE}. Static longitudinal stability must be shown at speeds from V_{NE} -20 kt to V_{NE} with:
(amended 2009/05/11)

(1) Critical weight;
(amended 2009/05/11)

(2) Critical centre of gravity;
(amended 2009/05/11)

(3) Power required for level flight at V_{NE} -10 kt or maximum continuous power, whichever is less;
(amended 2009/05/11)

(4) The landing gear retracted; and
(amended 2009/05/11)

(5) The rotorcraft trimmed at V_{NE} -10 kt.
(amended 2009/05/11)

(d) Autorotation. Static longitudinal stability must be shown in autorotation at:
(amended 2009/05/11)

(1) Airspeeds from the minimum rate of descent airspeed -10 kt to the minimum rate of descent airspeed +10 kt, with:
(amended 2009/05/11)

(i) Critical weight;

(ii) Critical centre of gravity;

(iii) The landing gear extended; and
(amended 2009/05/11)

(iv) The rotorcraft trimmed at the minimum rate of descent airspeed.
(amended 2009/05/11)

(2) Airspeeds from best angle-of-glide airspeed -10 kt to the best angle-of-glide airspeed +10 kt, with:
(amended 2009/05/11)

(i) Critical weight;
(amended 2009/05/11)

(ii) Critical centre of gravity;
(amended 2009/05/11)

(iii) The landing gear retracted; and
(amended 2009/05/11)

(iv) The rotorcraft trimmed at the best angle-of-glide airspeed.
(amended 2009/05/11)

(Change 527-4)

527.177 *Static Directional Stability*

(a) The directional controls must operate in such a manner that the sense and direction of motion of the rotorcraft following control displacement are in the direction of the pedal motion with the throttle and collective controls held constant at the trim conditions specified in 527.175(a), (b) and (c). Sideslip angles must increase with steadily increasing directional control deflection for sideslip angles up to the lesser of:
(amended 2009/05/11)

(1) ±25 degrees from trim at a speed of 15 knots less than the speed for minimum rate of descent varying linearly to ±10 degrees from trim at V_{NE};
(amended 2009/05/11)

(2) The steady state sideslip angles established by 527.351;
(amended 2009/05/11)

(3) A sideslip angle selected by the applicant, which corresponds to a sideforce of at least 0.1g; or
(amended 2009/05/11)

(4) The sideslip angle attained by maximum directional control input.
(amended 2009/05/11)

(b) Sufficient cues must accompany the sideslip to alert the pilot when the aircraft is approaching the sideslip limits.
(amended 2009/05/11)

(c) During the maneuver specified in paragraph (a) of this section, the sideslip angle versus directional control position curve may have a negative slope within a small range of angles

around trim, provided the desired heading can be maintained without exceptional piloting skill or alertness.
(amended 2009/05/11)

Ground and Water Handling Characteristics

527.231 *General*

The rotorcraft must have satisfactory ground and water handling characteristics, including freedom from uncontrollable tendencies in any condition expected in operation.

527.235 *Taxiing Condition*

The rotorcraft must be designed to withstand the loads that would occur when the rotorcraft is taxied over the roughest ground that may reasonably be expected in normal operation.

527.239 *Spray Characteristics*

If certification for water operation is requested, no spray characteristics during taxiing, takeoff , or landing may obscure the vision of the pilot or damage the rotors, propellers, or other parts of the rotorcraft.

527.241 *Ground Resonance*

The rotorcraft may have no dangerous tendency to oscillate on the ground with the rotor turning.

Miscellaneous Flight Requirements

527.251 *Vibration*

Each part of the rotorcraft must be free from excessive vibration under each appropriate speed and power condition.

SUBCHAPTER C
STRENGTH REQUIREMENTS - GENERAL

527.301 *Loads*

(a) Strength requirements are specified in terms of limit loads (the maximum loads to be expected in service) and ultimate loads (limit loads multiplied by prescribed factors of safety). Unless otherwise provided, prescribed loads are limit loads.

(b) Unless otherwise provided, the specified air, ground, and water loads must be placed in equilibrium with inertia forces, considering each item of mass in the rotorcraft. These loads must be distributed to closely approximate or conservatively represent actual conditions.

(c) If deflections under load would significantly change the distribution of external or internal loads, this redistribution must be taken into account.

527.303 *Factor of Safety*

Unless otherwise provided, a factor of safety of 1.5 must be used. This factor applies to external and inertia loads unless its application to the resulting internal stresses is more conservative.

527.305 *Strength and Deformation*

(a) The structure must be able to support limit loads without detrimental or permanent deformation. At any load up to limit loads, the deformation may not interfere with safe operation.

(b) The structure must be able to support ultimate loads without failure. This must be shown by:

(1) Applying ultimate loads to the structure in a static test for at least three seconds; or

(2) Dynamic tests simulating actual load application.

527.307 *Proof of Structure*

(a) Compliance with the strength and deformation requirements of this subchapter must be shown for each critical loading condition accounting for the environment to which the structure will be exposed in operation. Structural analysis (static or fatigue) may be used only if the structure conforms to those structures, for which experience has shown this method to be reliable. In other cases, substantiating load tests must be made.

(b) Proof of compliance with the strength requirements of this subchapter must include:

(1) Dynamic and endurance tests of rotors, rotor drives, and rotor controls;

(2) Limit load tests of the control system, including control surfaces;

(3) Operation tests of the control system;

(4) Flight stress measurement tests;

(5) Landing gear drop tests; and

(6) Any additional test required for new or unusual design features.

(Change 527-2 (92-02-01))

527.309 *Design Limitations*

The following values and limitations must be established to show compliance with the structural requirements of this subchapter:

(a) The design maximum weight.

(b) The main rotor r.p.m. ranges, power on and power off.

(c) The maximum forward speeds for each main rotor r.p.m. within the ranges determined under paragraph (b) of this section.

(d) The maximum rearward and sideward flight speeds.

(e) The centre of gravity limits corresponding to the limitations determined under paragraphs (b), (c), and (d) of this section.

(f) The rotational speed ratios between each powerplant and each connected rotating component.

(g) The positive and negative limit manoeuvring load factors.

Flight Loads

527.321 *General*

(a) The flight load factor must be assumed to act normal to the longitudinal axis of the rotorcraft, and to be equal in magnitude and opposite in direction to the rotorcraft inertia load factor at the centre of gravity.

(b) Compliance with the flight load requirements of this subchapter must be shown:

(1) At each weight from the design minimum weight to the design maximum weight; and

(2) With any practical distribution of disposable load within the operating limitations in the Rotorcraft Flight Manual.

527.337 *Limit Manoeuvring Load Factor*

The rotorcraft must be designed for:

(a) A limit manoeuvring load factor ranging from a positive limit of 3.5 to a negative limit of -1.0; or

(b) Any positive limit manoeuvring load factor not less than 2.0, and any negative limit manoeuvring load factor of not less than -0.5 for which:

(1) The probability of being exceeded is shown by analysis and flight tests to be extremely remote; and

(2) The selected values are appropriate to each weight condition between the design maximum and design minimum weights.

(Change 527-2 (92-02-01))

527.339 *Resultant Limit Manoeuvring Loads*

The loads resulting from the application of limit manoeuvring load factors are assumed to act at the centre of each rotor hub and at each auxiliary lifting surface, and to act in directions, and with distributions of load among the rotors and auxiliary lifting surfaces, so as to represent each critical manoeuvring condition, including power-on and power-off flight with the maximum design rotor tip speed ratio. The rotor tip speed ratio is the ratio of the rotorcraft flight velocity component in the plane of the rotor disc to the rotational tip speed of the rotor blades, and is expressed as follows:

$$\mu = \frac{V \cos\alpha}{\Omega R}$$

where:

V = The airspeed along flight path (f.p.s.);

α = The angle between the projection, in the plane of symmetry, of the axis of no feathering and a line perpendicular to the flight path (radians, positive when axis is pointing aft);

Ω = The angular velocity of rotor (radians per second); and

R = The rotor radius (ft.).

527.341 *Gust Loads*

The rotorcraft must be designed to withstand, at each critical airspeed including hovering, the loads resulting from a vertical gust of 30 feet per second.

527.351 *Yawing Conditions*

(a) Each rotorcraft must be designed for the loads resulting from the manoeuvres specified in paragraphs (b) and (c) of this section with:

(1) Unbalanced aerodynamic moments about the centre of gravity which the aircraft reacts to in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces; and

(2) Maximum main rotor speed.

(b) To produce the load required in paragraph (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from zero up to 0.6 V_{NE}:

(1) Displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in 527.397 (a);

(2) Attain a resulting sideslip angle or 90°, whichever is less; and

(3) Return the directional control suddenly to neutral.

(c) To produce the load required in paragraph (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from 0.6 V_{NE} up to V_{NE} or V_H, whichever is less:

(1) Displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in 527.397 (a);

(2) Attain a resulting sideslip angle or 15°, whichever is less, at the lesser speed of V_{NE} or V_H;

(3) Vary the sideslip angles of paragraphs (b)(2) and (c)(2) of this section directly with speed; and

(4) Return the directional control suddenly to neutral.

(Change 527-2 (92-02-01))

(Change 527-4)

527.361 *Engine Torque*

(a) For turbine engines, the limit torque may not be less than the highest of:

(1) The mean torque for maximum continuous power multiplied by 1.25;

(2) The torque required by 527.923;

(3) The torque required by 527.927; or

(4) The torque imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming).

(b) For reciprocating engines, the limit torque may not be less than the mean torque for maximum continuous power multiplied by:

(1) 1.33, for engines with five or more cylinders; and

(2) Two, three, and four, for engines with four, three, and two cylinders, respectively.

(Change 527-1 (89-01-01))

Control Surface and System Loads

527.391 *General*

Each auxiliary rotor, each fixed or movable stabilizing or control surface, and each system operating any flight control must meet the requirements of 527.395, 527.397, 527.399, 527.411, and 527.427.

(Change 527-2 (92-02-01))
(Change 527-4)

527.395 *Control System*

(a) The part of each control system from the pilot's controls to the control stops must be designed to withstand pilot forces of not less than:

(1) The forces specified in 527.397; or

(2) If the system prevents the pilot from applying the limit pilot forces to the system, the maximum forces that the system allows the pilot to apply, but not less than 0.60 times the forces specified in 527.397.

(b) Each primary control system, including its supporting structure, must be designed as follows:

(1) The system must withstand loads resulting from the limit pilot forces prescribed in 523.397.

(2) Notwithstanding paragraph (b)(3) of this section, when power-operated actuator controls or power boost controls are used, the system must also withstand the loads

resulting from the force output of each normally energized power device, including any single power boost or actuator system failure.

(3) If the system design or the normal operating loads are such that a part of the system cannot react to the limit pilot forces prescribed in 527.397, that part of the system must be designed to withstand the maximum loads that can be obtained in normal operation. The minimum design loads must, in any case, provide a rugged system for service use, including consideration of fatigue, jamming, ground gusts, control inertia, and friction loads. In the absence of rational analysis, the design loads resulting from 0.60 of the specified limit pilot forces are acceptable minimum design loads.

(4) If operational loads may be exceeded through jamming, ground gusts, control inertia, or friction, the system must withstand the limit pilot forces specified in 527.397, without yielding.

(Change 527-2 (92-02-01))

527.397 *Limit Pilot Forces and Torques*

(a) Except as provided in paragraph (b) of this section, the limit pilot forces are as follows:

(1) For foot controls, 130 pounds.

(2) For stick controls, 100 pounds fore and aft, and 67 pounds laterally.

(b) For flap, tab, stabilizer, rotor brake, and landing gear operating controls, the following apply (*R* = radius in inches):

(1) Crank, wheel, and level controls, $\left(\frac{1+R}{3}\right) x\,50$ pounds., but not less than 50 pounds nor more than 100 pounds for hand operated controls or 130 pounds for foot operated controls, applied at any angle with 20 degrees of the plane of motion of the control.

(2) Twist controls, 80R inch-pounds.
(amended 2001/10/24)

527.399 *Dual Control System*

Each dual primary flight control system must be designed to withstand the loads that result when pilot forces of 0.75 times those obtained under 527.395 are applied:

(a) In opposition; and

(b) In the same direction.

527.401 *(Removed)*

(Change 527-2 (92-02-01))

527.403 *(Removed)*

(Change 527-2 (92-02-01))

527.411 *Ground Clearance:Tail Rotor Guard*

(a) It must be impossible for the tail rotor to contact the landing surface during a normal landing.

(b) If a tail rotor guard is required to show compliance with paragraph (a) of this section:

(1) Suitable design loads must be established for the guard; and

(2) The guard and its supporting structure must be designed to withstand those loads.

527.413 *(Removed)*

(Change 527-2 (92-02-01))

527.427 *Unsymmetrical loads*

(a) Horizontal tail surfaces and their supporting structure must be designed for unsymmetrical loads arising from yawing and rotor wake effects in combination with the prescribed flight conditions.

(b) To meet the design criteria of paragraph (a) of this section, in the absence of more rational data, both of the following must be met:

(1) One hundred percent of the maximum loading from the symmetrical flight conditions acts on the surface on one side of the plane of symmetry, and no loading acts on the other side.

(2) Fifty percent of the maximum loading from the symmetrical flight conditions acts on the surface on each side of the plane of symmetry but in opposite directions.

(c) For empennage arrangements where the horizontal tail surfaces are supported by the vertical tail surfaces, the vertical tail surfaces and supporting structure must be designed for the combined vertical and horizontal surface loads resulting from each prescribed flight condition, considered separately. The flight conditions must be selected so the maximum design loads are obtained on each surface. In the absence of more rational data, the unsymmetrical horizontal tail surface loading distributions described in this section must be assumed.

(Change 527-2 (92-02-01))

Ground Loads

527.471 *General*

(a) Loads and equilibrium. For limit ground loads:

(1) The limit ground loads obtained in the landing conditions in this chapter must be considered to be external loads that would occur in the rotorcraft structure if it were acting as a rigid body; and

(2) In each specified landing condition, the external loads must be placed in equilibrium with linear and angular inertia loads in a rational or conservative manner.

(b) Critical centres of gravity. The critical centres of gravity within the range for which certification is requested must be selected so that the maximum design loads are obtained in each landing gear element.

527.473 *Ground Loading Conditions and Assumptions*

(a) For specified landing conditions, a design maximum weight must be used that is not less than the maximum weight. A rotor lift may be assumed to act through the centre of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight.

(b) Unless otherwise prescribed, for each specified landing condition, the rotorcraft must be designed for a limit load factor of not less than the limit inertia load factor substantiated under 527.725.

527.475 *Tires and Shock Absorbers*

Unless otherwise prescribed, for each specified landing condition, the tires must be assumed to be in their static position and the shock absorbers to be in their most critical position.

527.477 *Landing Gear Arrangement*

Sections 527.235, 527.479 through 527.485, and 527.493 apply to landing gear with two wheels aft, and one or more wheels forward, of the centre of gravity.

527.479 *Level Landing Conditions*

(a) Attitudes. Under each of the loading conditions prescribed in paragraph (b) of this section, the rotorcraft is assumed to be in each of the following level landing attitudes:

(1) An attitude in which all wheels contact the ground simultaneously.

(2) An attitude in which the aft wheels contact the ground with the forward wheels just clear of the ground.

(b) Loading conditions. The rotorcraft must be designed for the following landing and loading conditions:

(1) Vertical loads applied under 527.471.

(2) The loads resulting from a combination of the loads applied under subparagraph (1) of this paragraph with drag loads at each wheel of not less than 25 percent of the vertical load at that wheel.

(3) If there are two wheels forward, a distribution of the loads applied to those wheels under subparagraphs (1) and (2) of this paragraph in a ratio of 40:60.

(c) Pitching moments. Pitching moments are assumed to be resisted by:

(1) In the case of the attitude in paragraph (a)(1) of this section, the forward landing gear; and

(2) In the case of the attitude in paragraph (a)(2) of this section, the angular inertia forces.

527.481 *Tail-down Landing Conditions*

(a) The rotorcraft is assumed to be in the maximum nose-up attitude allowing ground clearance by each part of the rotorcraft.

(b) In this attitude, ground loads are assumed to act perpendicular to the ground.

527.483 *One-wheel Landing Conditions*

For the one-wheel landing condition, the rotorcraft is assumed to be in the level attitude and to contact the ground on one aft wheel. In this attitude:

(a) The vertical load must be the same as that obtained on that side under 527.479 (b)(1); and

(b) The unbalanced external loads must be reacted by rotorcraft inertia.

527.485 *Lateral Drift Landing Conditions*

(a) The rotorcraft is assumed to be in the level landing attitude, with:

(1) Side loads combined with one-half of the maximum ground reactions obtained in the level landing conditions of 527.479 (b)(1); and

(2) The loads obtained under subparagraph (1) of this paragraph applied:

(i) At the ground contact point; or

(ii) For full-swivelling gear, at the centre of the axle.

(b) The rotorcraft must be designed to withstand, at ground contact:

(1) When only the aft wheels contact the ground, side loads of 0.8 times the vertical reaction acting inward on one side, and 0.6 times the vertical reaction acting outward on the other side, all combined with the vertical loads specified in paragraph (a) of this section; and

(2) When all wheels contact the ground simultaneously:

(i) For the aft wheels, the side loads specified in subparagraph (1) of this paragraph; and

(ii) For the forward wheels, a side load 0.8 times the vertical reaction combined with the vertical load specified in paragraph (a) of this section.

527.493 *Braked Roll Conditions*

Under braked roll conditions with the shock absorbers in their static positions:

(a) The limit vertical load must be based on a load factor of at least:

(1) 1.33, for the attitude specified in 527.479 (a)(1); and

(2) 1.0, for the attitude specified in 527.479 (a)(2); and

(b) The structure must be designed to withstand, at the ground contact point of each wheel with brakes, a drag load at least the lesser of:

(1) The vertical load multiplied by a coefficient of friction of 0.8; and

(2) The maximum value based on limiting brake torque.

527.497 *Ground Loading Conditions:Landing Gear with Tail Wheels*

(a) General. Rotorcraft with landing gear with two wheels forward, and one wheel aft, of the centre of gravity must be designed for loading conditions as prescribed in this section.

(b) Level landing attitude with only the forward wheels contacting the ground. In this attitude:

(1) The vertical loads must be applied under 527.471 through 527.475;

(2) The vertical load at each axle must be combined with a drag load at that axle of not less than 25 percent of that vertical load; and

(3) Unbalanced pitching moments are assumed to be resisted by angular inertia forces.

(c) Level landing attitude with all wheels contacting the ground simultaneously. In this attitude, the rotorcraft must be designed for landing loading conditions as prescribed in paragraph (b) of this section.

(d) Maximum nose-up attitude with only the rear wheel contacting the ground. The attitude for this condition must be the maximum nose-up attitude expected in normal operation, including autorotative landings. In this attitude:

(1) The appropriate ground loads specified in paragraphs (b)(1) and (2) of this section must be determined and applied, using a rational method to account for the moment arm between the rear wheel ground reaction and the rotorcraft centre of gravity; or

(2) The probability of landing with initial contact on the rear wheel must be shown to be extremely remote.

(e) Level landing attitude with only one forward wheel contacting the ground. In this attitude, the rotorcraft must be designed for ground loads as specified in paragraphs (b)(1) and (3) of this section.

(f) Side loads in the level landing attitude. In the attitudes specified in paragraphs (b) and (c) of this section, the following apply:

(1) The side loads must be combined at each wheel with one-half of the maximum vertical ground reactions obtained for that wheel under paragraphs (b) and (c) of this section. In this condition, the side loads must be:

(i) For the forward wheels, 0.8 times the vertical reaction (on one side) acting inward, and 0.6 times the vertical reaction (on the other side) acting outward; and

(ii) For the rear wheel, 0.8 times the vertical reaction.

(2) The loads specified in subparagraph (1) of this paragraph must be applied:

(i) At the ground contact point with the wheel in the trailing position (for non-full swivelling landing gear or for full swivelling landing gear with a lock, steering device, or shimmy damper to keep the wheel in the trailing position); or

(ii) At the centre of the axle (for full swivelling landing gear without a lock, steering device, or shimmy damper).

(g) Braked roll conditions in the level landing attitude. In the attitudes specified in paragraphs (b) and (c) of this section, and with the shock absorbers in their static positions, the rotorcraft must be designed for braked roll loads as follows:

(1) The limit vertical load must be based on a limit vertical load factor of not less than:

(i) 1.0, for the attitude specified in paragraph (b) of this section; and

(ii) 1.33, for the attitude specified in paragraph (c) of this section.

(2) For each wheel with brakes, a drag load must be applied, at the ground contact point, of not less than the lesser of:

(i) 0.8 times the vertical load; and

(ii) The maximum based on limiting brake torque.

(h) Rear wheel turning loads in the static ground attitude. In the static ground attitude, and with the shock absorbers and tires in their static positions, the rotorcraft must be designed for rear wheel turning loads as follows:

(1) A vertical ground reaction equal to the static load on the rear wheel must be combined with an equal sideload.

(2) The load specified in subparagraph (1) of this paragraph must be applied to the rear landing gear:

(i) Through the axle, if there is a swivel (the rear wheel being assumed to be swivelled 90 degrees to the longitudinal axis of the rotorcraft); or

(ii) At the ground contact point, if there is a lock, steering device or shimmy damper (the rear wheel being assumed to be in the trailing position).

(iii) *Taxiing condition.* The rotorcraft and its landing gear must be designed for loads that would occur when the rotorcraft is taxied over the roughest ground that may reasonably be expected in normal operation.

527.501 *Ground Loading Conditions:Landing Gear with Skids*

(a) General. Rotorcraft with landing gear with skids must be designed for the loading conditions specified in this section. In showing compliance with this section, the following apply:

(1) The design maximum weight, centre of gravity, and load factor must be determined under 527.471 through 527.475.

(2) Structural yielding of elastic spring members under limit loads is acceptable.

(3) Design ultimate loads for elastic spring members need not exceed those obtained in a drop test of the gear with:

(i) A drop height of 1.5 times that specified in 527.725; and

(ii) An assumed rotor lift of not more than 1.5 times that used in the limit drop tests prescribed in 527.725.

(4) Compliance with paragraphs (b) through (e) of this section must be shown with:

(i) The gear in its most critically deflected position for the landing condition being considered; and

(ii) The ground reactions rationally distributed along the bottom of the skid tube.

(b) Vertical reactions in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the vertical reactions must be applied as prescribed in paragraph (a) of this section.

(c) Drag reactions in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) The vertical reactions must be combined with horizontal drag reactions of 50 percent of the vertical reaction applied at the ground.

(2) The resultant ground loads must equal the vertical load specified in paragraph (b) of this section.

(d) Sideloads in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) The vertical ground reaction must be:

(i) Equal to the vertical loads obtained in the condition specified in paragraph (b) of this section; and

(ii) Divided equally among the skids.

(2) The vertical ground reactions must be combined with a horizontal sideload of 25 percent of their value.

(3) The total sideload must be applied equally between the skids and along the length of the skids.

(4) The unbalanced moments are assumed to be resisted by angular inertia.

(5) The skid gear must be investigated for:

(i) Inward acting sideloads; and

(ii) Outward acting sideloads;

(e) One-skid landing loads in the level attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of one skid only, the following apply:

(1) The vertical load on the ground contact side must be the same as that obtained on that side in the condition specified in paragraph (b) of this section.

(2) The unbalanced moments are assumed to be resisted by angular inertia.

(f) Special conditions. In addition to the conditions specified in paragraphs (b) and (c) of this section, the rotorcraft must be designed for the following ground reactions:

(1) A ground reaction load acting up and aft at an angle of 45 degrees to the longitudinal axis of the rotorcraft. This load must be:

(i) Equal to 1.33 times the maximum weight;

(ii) Distributed symmetrically among the skids;

(iii) Concentrated at the forward end of the straight part of the skid tube; and

(iv) Applied only to the forward end of the skid tube and its attachment to the rotorcraft.

(2) With the rotorcraft in the level landing attitude, a vertical ground reaction load equal to one-half of the vertical load determined under paragraph (b) of this section. This load must be:

(i) Applied only to the skid tube and its attachment to the rotorcraft; and

(ii) Distributed equally over 33.3 percent of the length between the skid tube attachments and centrally located midway between the skid tube attachments.

(Change 527-2 (92-02-01))

527.505 *Ski Landing Conditions*

If certification for ski operation is requested, the rotorcraft, with skis, must be designed to withstand the following loading conditions (where P is the maximum static weight on each ski with the rotorcraft at design maximum weight, and n is the limit load factor determined under 527.473 (b)).

(a) Up-load conditions in which:

(1) A vertical load of Pn and a horizontal load of $Pn/4$ are simultaneously applied at the pedestal bearings; and

(2) A vertical load of 1.33 P is applied at the pedestal bearings.

(b) A side-load condition in which a side load of 0.35 Pn is applied at the pedestal bearings in a horizontal plane perpendicular to the centreline of the rotorcraft.

(c) A torque-load condition in which a torque of 1.33 P (in foot pounds) is applied to the ski about the vertical axis through the centreline of the pedestal bearings.

Water Loads

527.521 *Float Landing Conditions*

If certification for float operations is requested, the rotorcraft, with floats, must be designed to withstand the following loading conditions (where the limit load factor is determined under 527.473 (b) or assumed to be equal to that determined for wheel landing gear):

(a) Up-load conditions in which:

(1) A load is applied so that, with the rotorcraft in the static level attitude, the resultant water reaction passes vertically through the centre of gravity; and

(2) The vertical load prescribed in subparagraph (1) of this paragraph is applied simultaneously with an aft component of 0.25 times the vertical component.

(b) A side-load condition in which:

(1) A vertical load of 0.75 times the total vertical load specified in paragraph (a)(1) of this section is divided equally among the floats; and

(2) For each float, the load share determined under subparagraph (1) of this paragraph, combined with a total side load of 0.25 times the total vertical load specified in subparagraph (1) of this paragraph, is applied to that float only.

Main Component Requirements

527.547 *Main Rotor Structure*

(a) Each main rotor assembly (including rotor hubs and blades) must be designed as prescribed in this section.

(b) (Reserved)

(c) The main rotor structure must be designed to withstand the following loads prescribed in 527.337 through 527.341:

(1) Critical flight loads.

(2) Limit loads occurring under normal conditions of autorotation. For this condition, the rotor r.p.m. must be selected to include the effects of altitude.

(d) The main rotor structure must be designed to withstand loads simulating:

(1) For the rotor blades, hubs, and flapping hinges, the impact force of each blade against its stop during ground operation; and

(2) Any other critical condition expected in normal operation.

(e) The main rotor structure must be designed to withstand the limit torque at any rotational speed, including zero. In addition:

(1) The limit torque need not be greater than the torque defined by a torque limiting device (where provided), and may not be less than the greater of:

(i) The maximum torque likely to be transmitted to the rotor structure in either direction; and

(ii) The limit engine torque specified in 527.361.

(2) The limit torque must be distributed to the rotor blades in a rational manner.

527.549 *Fuselage, Landing Gear, and Rotor Pylon Structures*

(a) Each fuselage, landing gear, and rotor pylon structure must be designed as prescribed in this section. Resultant rotor forces may be represented as a single force applied at the rotor hub attachment point.

(b) Each structure must be designed to withstand:

(1) The critical loads prescribed in 527.337 through 527.341;

(2) The applicable ground loads prescribed in 527.235, 527.471 through 527.485, 527.493, 527.497, 527.501, 527.505 and 527.521; and

(3) The loads prescribed in 527.457 (d)(2) and (e).

(c) Auxiliary rotor thrust, and the balancing air and inertia loads occurring under accelerated flight conditions, must be considered.

(d) Each engine mount and adjacent fuselage structure must be designed to withstand the loads occurring under accelerated flight and landing conditions, including engine torque.

Emergency Landing Conditions

527.561 *General*

(a) The rotorcraft, although it may be damaged in emergency landing conditions on land or water, must be designed as prescribed in this section to protect the occupants under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a crash landing when:

(1) Proper use is made of seats, belts, and other safety design provisions;

(2) The wheels are retracted (where applicable); and

(3) Each occupant and each item of mass inside the cabin that could injure an occupant is restrained when subjected to the following ultimate inertial load factors relative to the surrounding structure:

(i) Upward - 4g.

(ii) Forward - 16g.

(iii) Sideward - 8g.

(iv) Downward - 20g, after intended displacement of the seat device.

(v) Rearward - 1.5g.

(c) The supporting structure must be designed to restrain, under any ultimate inertial load up to those specified in this paragraph, any item of mass above and/or behind the crew and passenger compartment that could injure an occupant if it came loose in an emergency landing. Items of mass to be considered include, but are not limited to, rotors, transmissions, and engines. The items of mass must be restrained for the following ultimate inertial load factors:

(1) Upward - 1.5g.

(2) Forward - 12g.

(3) Sideward - 6g.

(4) Downward - 12g.

(5) Rearward - 1.5g.

(d) Any fuselage structure in the area of internal fuel tanks below the passenger floor level must be designed to resist the following ultimate inertial factors and loads and to protect the fuel tanks from rupture when those loads are applied to that area:

(i) Upward - 1.5g.

(ii) Forward - 4.0g.

(iii) Sideward - 2.0g.

(iv) Downward - 4.0g.

(Change 527-2 (92-02-01))

(Change 527-3 (94-01-03))

(Change 527-4)

527.562 *Emergency Landing Dynamic Conditions*

(a) The rotorcraft, although it may be damaged in an emergency crash landing, must be designed to reasonably protect each occupant when:

(1) The occupant properly uses the seats, safety belts, and shoulder harnesses provided in the design; and

(2) The occupant is exposed to the loads resulting from the conditions prescribed in this section.

(b) Each seat type design or other seating device approved for crew or passenger occupancy during take-off and landing must successfully complete dynamic tests or be demonstrated by rational analysis based on dynamic tests of a similar type seat in accordance with the following criteria. The tests must be conducted with an occupant, simulated by a 170-pound anthropomorphic test dummy (ATD), as defined by *Federal Aviation Regulations*, Title 49 CFR 572, Subpart B of the U.S.A., or its equivalent, sitting in the normal upright position.

(1) A change in downward velocity of not less than 30 feet per second when the seat or other seating device is oriented in its nominal position with respect to the rotorcraft's reference system, the rotorcraft's longitudinal axis is canted upward 60° with respect to the impact velocity vector, and the rotorcraft's lateral axis is perpendicular to a vertical

plane containing the impact velocity vector and the rotorcraft's longitudinal axis. Peak floor deceleration must occur in not more than 0.031 seconds after impact and must reach a minimum of 30g's.

(2) A change in forward velocity of not less than 42 feet per second when the seat or other seating device is oriented in its nominal position with respect to the rotorcraft's reference system, the rotorcraft's longitudinal axis is yawed 10° either right or left of the impact velocity vector (whichever would cause the greatest load on the shoulder harness), the rotorcraft's lateral axis is contained in a horizontal plane containing the impact velocity vector, and the rotorcraft's vertical axis is perpendicular to a horizontal plane containing the impact velocity vector. Peak floor deceleration must occur in not more than 0.071 seconds after impact and must reach a minimum of 18.4g's.

(3) Where floor rails or floor or sidewall attachment devices are used to attach the seating devices to the airframe structure for the conditions of this section, the rails or devices must be misaligned with respect to each other by at least 10° vertically (i.e., pitch out of parallel) and by at least a 10° lateral roll, with the directions optional, to account for possible floor warp.

(c) Compliance with the following must be shown:

(1) The seating device system must remain intact although it may experience separation intended as part of its design.

(2) The attachment between the seating device and the airframe structure must remain intact, although the structure may have exceeded its limit load.

(3) The ATD's shoulder harness strap or straps must remain on or in the immediate vicinity of the ATD's shoulder during the impact.

(4) The safety belt must remain on the ATD's pelvis during the impact.

(5) The ATD's head either does not contact any portion of the crew or passenger compartment, or if contact is made, the head impact does not exceed a head injury criteria (HIC) of 1,000 as determined by this equation.

$$\mathrm{HIC} = (t_2 - t_1)\left[\frac{1}{(t_2 - t_1)}\int_{t1}^{t2} a(t)dt\right]^{2.5}$$

Where: a(t) is the resultant acceleration at the centre of gravity of the head form expressed as a multiple of g (the acceleration of gravity) and $t_2 - t_1$ is the time duration, in seconds, of major head impact, not to exceed 0.05 seconds.

(6) Loads in individual upper torso harness straps must not exceed 1,750 pounds. If dual straps are used for retaining the upper torso, the total harness strap loads must not exceed 2,000 pounds.

(7) The maximum compressive load measured between the pelvis and the lumbar column of the ATD must not exceed 1,500 pounds.

(d) An alternate approach that achieves an equivalent or greater level of occupant protection, as required by this section, must be substantiated on a rational basis.

(Change 527-2 (92-02-01))

527.563 *Structural Ditching Provisions*

If certification with ditching provisions is requested, structural strength for ditching must meet the requirements of this section and 527.801(e).

(a) Forward speed landing conditions. The rotorcraft must initially contact the most critical wave for reasonably probable water conditions at forward velocities from zero up to 30 knots in likely pitch, roll, and yaw attitudes. The rotorcraft limit vertical descent velocity may not be less than 5 feet per second relative to the mean water surface. Rotor lift may be used to act through the centre of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine-out touch down.

(b) Auxiliary or emergency float conditions:

(1) *Floats fixed or deployed before initial water contact.* In addition to the landing loads in paragraph (a) of this section, each auxiliary or emergency float, of its support and attaching structure in the airframe or fuselage, must be designed for the load developed by a fully immersed float unless it can be shown that full immersion is unlikely. If full immersion is unlikely, the highest likely float buoyancy load must be applied. The highest likely buoyancy load must include consideration of a partially immersed float creating restoring moments to compensate the upsetting moments caused by side wind, unsymmetrical rotorcraft loading, water wave action, rotorcraft inertia, and probable structural damage and leakage considered under 527.801(d). Maximum roll and pitch angles determined from compliance with 527.801(d) may be used, if significant, to determine the extent of immersion of each float. If the floats are deployed in flight, appropriate air loads derived from the flight limitations with the floats deployed shall be used in substantiation of the floats and their attachment to the rotorcraft. For this purpose, the design airspeed for limit load is the float deployed airspeed operating limit multiplied by 1.11.

(2) *Floats deployed after initial water contact.* Each float must be designed for full or partial immersion prescribed in paragraph (b)(1) of this section. In addition, each float must be designed for combined vertical and drag loads using a relative limit speed of 20 knots between the rotorcraft and the water. The vertical load may not be less than the highest likely buoyancy load determined under paragraph (b)(1) of this section.

(Change 527-2 (92-02-01))

Fatigue Evaluation

527.571 *Fatigue Evaluation of Flight Structure*

(a) General. Each portion of the flight structure (the flight structure includes rotors, rotor drive systems between the engines and the rotor hubs, controls, fuselage, landing gear, and their related primary attachments), the failure of which could be catastrophic, must be

identified and must be evaluated under paragraph (b), (c), (d) or (e) of this section. The following apply to each fatigue evaluation:

(1) The procedure for the evaluation must be approved.

(2) The locations of probable failure must be determined.

(3) In-flight measurement must be included in determining the following:

(i) Loads or stresses in all critical conditions throughout the range of limitations in 527.309, except that manoeuvring load factors need not exceed the maximum values expected in operation.

(ii) The effect of altitude upon these loads or stresses.

(4) The loading spectra must be as severe as those expected in operation including, but not limited to, external cargo operations, if applicable, and ground-air-ground cycles. The loading spectra must be based on loads or stresses determined under paragraph (a)(3) of this section.

(b) Fatigue tolerance evaluation. It must be shown that the fatigue tolerance of the structure ensures that the probability of catastrophic fatigue failure is extremely remote without establishing replacement times, inspection intervals or other procedures under A527.4 of Appendix A.

(c) Replacement time evaluation. It must be shown that the probability of catastrophic fatigue failure is extremely remote within a replacement time furnished under A527.4 of Appendix A.

(d) Fail-safe evaluation. The following apply to fail-safe evaluations:

(1) It must be shown that all partial failures will become readily detectable under inspection procedures furnished under A527.4 of Appendix A.

(2) The interval between the time when any partial failure becomes readily detectable under subparagraph (1), and the time when any such failure is expected to reduce the remaining strength of the structure to limit or maximum attainable loads (whichever is less), must be determined.

(3) It must be shown that the interval determined under subparagraph (2) is long enough, in relation to the inspection intervals and related procedures furnished under A527.4 of Appendix A, to provide a probability of detection great enough to ensure that the probability of catastrophic failure is extremely remote.

(e) Combination of replacement time and fail-safe evaluations. A component may be evaluated under a combination of paragraphs (c) and (d) of this section. For such component it must be shown that the probability of catastrophic failure is extremely remote with an approved combination of replacement time, inspection intervals, and related procedures furnished under A527.4 of Appendix A.

(Change 527-2 (92-02-01))

SUBCHAPTER D
DESIGN AND CONSTRUCTION - GENERAL

527.601 *Design*

(a) The rotorcraft may have no design features or details that experience has shown to be hazardous or unreliable.

(b) The suitability of each questionable design detail and part must be established by tests.

527.602 *Critical Parts*
(amended 2003/06/23)

(a) Critical part. A critical part is a part, the failure of which could have a catastrophic effect upon the rotorcraft and for which critical characteristics have been identified which, in turn, must be controlled to ensure the required level of integrity.
(amended 2009/12/01)

(b) If the type design includes critical parts, a critical parts list is established. Procedures are established to define the critical design characteristics, identify processes that affect those characteristics and identify the design change and process change controls necessary for showing compliance with the quality assurance requirements of Part V, Subparts 21, 61, 71 and Part VI, Subpart 5 of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

527.603 *Materials*

The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must:

(a) Be established on the basis of experience or tests;

(b) Meet approved specifications that ensure their having the strength and other properties assumed in the design data; and

(c) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

527.605 *Fabrication Methods*

(a) The methods of fabrication used must produce consistently sound structures. If a fabrication process (such as gluing, spot welding, or heat-treating) requires close control to reach this objective, the process must be performed according to an approved process specification.

(b) Each new aircraft fabrication method must be substantiated by a test program.

527.607 *Fasteners*

(a) Each removable bolt, screw, nut, pin, or other fastener whose loss could jeopardize the safe operation of the rotorcraft must incorporate two separate locking devices. The fastener and its locking devices may not be adversely affected by the environmental conditions associated with the particular installation.

(b) No self-locking nut may be used on any bolt subject to rotation in operation unless a non-friction locking device is used in addition to the self-locking device.

527.609 *Protection of Structure*

Each part of the structure must:

(a) Be suitably protected against deterioration or loss of strength in service due to any cause, including:

(1) Weathering;

(2) Corrosion; and

(3) Abrasion; and

(b) Have provisions for ventilation and drainage where necessary to prevent the accumulation of corrosive, flammable, or noxious fluids.

527.610 *Lightning and Static Electricity Protection*

(a) The rotorcraft must be protected against catastrophic effects from lightning.

(b) For metallic components, compliance with paragraph (a) of this section may be shown by:

(1) Electrically bonding the components properly to the airframe; or

(2) Designing the components so that a strike will not endanger the rotorcraft.

(c) For non-metallic components, compliance with paragraph (a) of this section may be shown by:

(1) Designing the components to minimize the effect of a strike; or

(2) Incorporating acceptable means of diverting the resulting electrical current so as not to endanger the rotorcraft.

(d) The electrical bonding and protection against lightning and static electricity must:

(1) Minimize the accumulation of electrostatic charge;

(2) Minimize the risk of electric shock to crew, passengers, and service and maintenance personnel using normal precautions;

(3) Provide an electrical return path, under both normal and fault conditions, on rotorcraft having grounded electrical systems; and

(4) Reduce to an acceptable level the effects of lightning and static electricity on the functioning of essential electrical and electronic equipment.

(Change 527-4)

527.611 *Inspection Provisions*

There must be means to allow the close examination of each part that requires:

(a) Recurring inspection;

(b) Adjustment for proper alignment and functioning; or

(c) Lubrication.

527.613 *Material Strength Properties and Design Values*

(a) Material strength properties must be based on enough tests of material meeting specifications to establish design values on a statistical basis.

(b) Design values must be chosen to minimize the probability of structural failure due to material variability. Except as provided in paragraphs (d) and (e) of this section, compliance with this paragraph must be shown by selecting design values that assure material strength with the following probability:

(1) Where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component, 99 percent probability with 95 percent confidence; and

(2) For redundant structure, those in which the failure of individual elements would result in applied loads being safely distributed to other load-carrying members, 90 percent probability with 95 percent confidence.

(c) The strength, detail design, and fabrication of the structure must minimize the probability of disastrous fatigue failure, particularly at points of stress concentration.

(d) Design values may be those contained in the following publications (available from the Naval Publications and Forms Centre, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120 U.S.A.) or other values approved by the Minister:
(amended 2003/11/19)

(1) MIL-HDBK-5, "Metallic Materials and Elements for Flight Vehicle Structure".

(2) MIL-HDBK-17, "Plastics for Flight Vehicles".

(3) ANC-18, "Design of Wood Aircraft Structures".

(4) MIL-HDBK-23, "Composite Construction for Flight Vehicles".

(e) Other design values may be used if a selection of the material is made in which a specimen of each individual item is tested before use and it is determined that the actual strength properties of that particular item will equal or exceed those used in design.

(Change 527-2 (92-02-01))

527.619 *Special Factors*

(a) The special factors prescribed in 527.621 through 527.625 apply to each part of the structure whose strength is:

(1) Uncertain;

(2) Likely to deteriorate in service before normal replacement; or

(3) Subject to appreciable variability due to:

(i) Uncertainties in manufacturing processes; or

(ii) Uncertainties in inspection methods.

(b) For each part to which 527.621 through 527.625 apply, the factor of safety prescribed in 527.303 must be multiplied by a special factor equal to:

(1) The applicable special factors prescribed in 527.621 through 527.625; or

(2) Any other factor great enough to ensure that the probability of the part being under strength because of the uncertainties specified in paragraph (a) of this section is extremely remote.

527.621 *Casting Factors*

(a) General. The factors, tests, and inspections specified in paragraphs (b) and (c) of this section must be applied in addition to those necessary to establish foundry quality control. The inspections must meet approved specifications. Paragraphs (c) and (d) of this section apply to structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads.

(b) Bearing stresses and surfaces. The casting factors specified in paragraphs (c) and (d) of this section:

(1) Need not exceed 1.25 with respect to bearing stresses regardless of the method of inspection used; and

(2) Need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

(c) Critical castings. For each casting whose failure would preclude continued safe flight and landing of the rotorcraft or result in serious injury to any occupant, the following apply:

(1) Each critical casting must:

(i) Have a casting factor of not less than 1.25; and

(ii) Receive 100 percent inspection by visual, radiographic, and magnetic particle (for ferromagnetic materials) or penetrant (for non-ferromagnetic materials) inspection methods or approved equivalent inspection methods.

(2) For each critical casting with a casting factor less that 1.50, three sample castings must be static tested and shown to meet:

(i) The strength requirements of 527.305 at an ultimate load corresponding to a casting factor of 1.25; and

(ii) The deformation requirements of 527.305 at a load of 1.15 times the limit load.

(d) Non-critical castings. For each casting other than those specified in paragraph (c) of this section, the following apply:

(1) Except as provided in subparagraphs (2) and (3) of this paragraph, the casting factors and corresponding inspections must meet the following table:

Casting Factor	Inspection
2.0 or greater	100 % visual.
Less than 2.0, greater than 1.5	100 % visual, and magnetic particle (ferromagnetic materials), penetrant (non-ferromagnetic materials), or approved equivalent inspection methods.
1.25 through 1.5	100 % visual, and magnetic particle (ferromagnetic materials), penetrant (non-ferromagnetic materials), and radiographic or approved equivalent inspection methods.

(2) The percentage of castings inspected by non-visual methods may be reduced below that specified in subparagraph (1) of this paragraph when an approved quality control procedure is established.

(3) For castings procured to a specification that guarantees the mechanical properties of the material in the casting and provides for demonstration of these properties by test of coupons cut from the castings on a sampling basis:

(i) A casting factor of 1.0 may be used; and

(ii) The castings must be inspected as provided in subparagraph (1) of this paragraph for casting factors of "1.25 through 1.50" and tested under paragraph (c)(2) of this section.

(Change 527-4)

527.623 *Bearing Factors*

(a) Except as provided in paragraph (b) of this section, each part that has clearance (free fit), and that is subject to pounding or vibration, must have a bearing factor large enough to provide for the effects of normal relative motion.

(b) No bearing factor need be used on a part for which any larger special factor is prescribed.

527.625 *Fitting Factors*

For each fitting (part or terminal used to join one structural member to another) the following apply:

(a) For each fitting whose strength is not proven by limit and ultimate load tests in which actual stress conditions are simulated in the fitting and surrounding structures, a fitting factor of at least 1.15 must be applied to each part of:

(1) The fitting;

(2) The means of attachment; and

(3) The bearing on the joined members.

(b) No fitting factor need be used:

(1) For joints made under approved practices and based on comprehensive test data (such as continuous joints in metal plating, welded joints, and scarf joints in wood); and

(2) With respect to any bearing surface for which a larger special factor is used.

(c) For each integral fitting, the part must be treated as a fitting up to the point at which the section properties become typical of the member.

(d) Each seat, berth, litter, safety belt, and harness attachment to the structure must be shown by analysis, tests, or both, to be able to withstand the inertia forces prescribed in 527.561(b)(3) multiplied by a fitting factor of 1.33.

(Change 527-4)

527.629 *Flutter*

Each aerodynamic surface of the rotorcraft must be free from flutter under each appropriate speed and power condition.

(Change 527-2 (92-02-01))

Rotors

527.653 *Pressure Venting and Drainage of Rotor Blades*

(a) For each rotor blade:

(1) There must be means for venting the internal pressure of the blade;

(2) Drainage holes must be provided for the blade; and

(3) The blade must be designed to prevent water from becoming trapped in it.

(b) Paragraphs (a)(1) and (2) of this section do not apply to sealed rotor blades capable of withstanding the maximum pressure differentials expected in service.

527.659 *Mass Balance*

(a) The rotors and blades must be mass balanced as necessary to:

(1) Prevent excessive vibration; and

(2) Prevent flutter at any speed up to the maximum forward speed.

(b) The structural integrity of the mass balance installation must be substantiated.

527.661 *Rotor Blade Clearance*

There must be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure during any operating condition.

527.663 *Ground Resonance Prevention Means*

(a) The reliability of the means for preventing ground resonance must be shown either by analysis and tests, or reliable service experience, or by showing through analysis or tests that malfunction or failure of a single means will not cause ground resonance.

(b) The probable range of variations, during service, of the damping action of the ground resonance prevention means must be established and must be investigated during the test required by 527.241.

(Change 527-2 (92-02-01))

Control Systems

527.671 *General*

(a) Each control and control system must operate with the ease, smoothness, and positiveness appropriate to its function.

(b) Each element of each flight control system must be designed, or distinctively and permanently marked, to minimize the probability of any incorrect assembly that could result in the malfunction of the system.

527.672 *Stability Augmentation, Automatic, and Power-Operated Systems*

If the functioning of stability augmentation or other automatic or power-operated systems is necessary to show compliance with the flight characteristics requirements of this chapter, such systems must comply with 527.671 of this chapter and the following:

(a) A warning which is clearly distinguishable to the pilot under expected flight conditions without requiring the pilot's attention must be provided for any failure in the stability augmentation system or in any other automatic or power-operated system which could result in an unsafe condition if the pilot is unaware of the failure. Warning systems must not activate the control systems.

(b) The design of the stability augmentation system or of any other automatic or power-operated system must allow initial counteraction of failures without requiring exceptional pilot skill or strength by overriding the failure by movement of the flight controls in the normal sense and deactivating the failed system.

(c) It must be shown that after any single failure of the stability augmentation system or any other automatic or power-operated system:

(1) The rotorcraft is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations;

(2) The controllability and manoeuvrability requirements of this chapter are met within a practical operational flight envelope (for example, speed, altitude, normal acceleration, and rotorcraft configurations) which is described in the Rotorcraft Flight Manual; and

(3) The trim and stability characteristics are not impaired below a level needed to permit continued safe flight and landing.

527.673 *Primary Flight Control*

Primary flight controls are those used by the pilot for immediate control of pitch, roll, yaw, and vertical motion of the rotorcraft.

527.674 *Interconnected Controls*

Each primary flight control system must provide for safe flight and landing and operate independently after a malfunction, failure, or jam of any auxiliary interconnected control.

(Change 527-2 (92-02-01))

527.675 *Stops*

(a) Each control system must have stops that positively limit the range of motion of the pilot's controls.

(b) Each stop must be located in the system so that the range of travel of its control is not appreciably affected by:

(1) Wear;

(2) Slackness; or

(3) Take-up adjustments.

(c) Each stop must be able to withstand the loads corresponding to the design conditions for the system.

(d) For each main rotor blade:

(1) Stops that are appropriate to the blade design must be provided to limit travel of the blade about its hinge points; and

(2) There must be means to keep the blade from hitting the droop stops during any operation other than starting and stopping the rotor.

527.679 *Control System Locks*

If there is a device to lock the control system with the rotorcraft on the ground or water, there must be means to:

(a) Give unmistakable warning to the pilot when the lock is engaged; and

(b) Prevent the lock from engaging in flight.

527.681 *Limit Load Static Tests*

(a) Compliance with the limit load requirements of this chapter must be shown by tests in which:

(1) The direction of the test loads produces the most severe loading in the control system; and

(2) Each fitting, pulley, and bracket used in attaching the system to the main structure is included.

(b) Compliance must be shown (by analyses or individual load tests) with the special factor requirements for control system joints subject to angular motion.

527.683 *Operation Tests*

It must be shown by operation tests that, when the controls are operated from the pilot compartment with the control system loaded to correspond with loads specified for the system, the system is free from:

(a) Jamming;

(b) Excessive friction; and

(c) Excessive deflection.

527.685 *Control System Details*

(a) Each detail of each control system must be designed to prevent jamming, chafing, and interference from cargo, passengers, loose objects, or the freezing of moisture.

(b) There must be means in the cockpit to prevent the entry of foreign objects into places where they would jam the system.

(c) There must be means to prevent the slapping of cables or tubes against other parts.

(d) Cable systems must be designed as follows:

(1) Cables, cable fittings, turnbuckles, splices, and pulleys must be of an acceptable kind.

(2) The design of the cable systems must prevent any hazardous change in cable tension throughout the range of travel under any operating conditions and temperature variations.

(3) No cable smaller than three thirty-seconds of an inch diameter may be used in any primary control system.

(4) Pulley kinds and sizes must correspond to the cables with which they are used. The pulley cable combinations and strength values which must be used are specified in Military Handbook MIL-HDBK-5C, Vol. 1 & Vol. 2, Metallic Materials and Elements for Flight Vehicle Structures, (Sept. 15, 1976, as amended through December 15, 1978). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 USC Section 552(a) and 1 CFR part 51. Copies may be obtained from the Naval Publications and Forms Centre, 5801 Tabor Avenue, Philadelphia, Pennsylvania, 19120. Copies may be inspected at the FAA, Rotorcraft Standards Staff, 4400 Blue Mount Road, Fort Worth, Texas, or at the Office of the Federal Register, 800 North Capitol Street, N.W.; Suite 700, Washington, DC.

(5) Pulleys must have close fitting guards to prevent the cables from being displaced or fouled.

(6) Pulleys must lie close enough to the plane passing through the cable to prevent the cable from rubbing against the pulley flange.

(7) No fairlead may cause a change in cable direction of more than 3°.

(8) No clevis pin subject to load or motion and retained only by cotter pins may be used in the control system.

(9) Turnbuckles attached to parts having angular motion must be installed to prevent binding throughout the range of travel.

(10) There must be means for visual inspection at each fairlead, pulley, terminal, and turnbuckle.

(e) Control system joints subject to angular motion must incorporate the following special factors with respect to the ultimate bearing strength of the softest material used as a bearing:

(1) 3.33 for push-pull systems other than ball and roller bearing systems.

(2) 2.0 for cable systems.

(f) For control system joints, the manufacturer's static, non-Brinell rating of ball and roller bearings must not be exceeded.

(Change 527-2 (92-02-01))

527.687 *Spring Devices*

(a) Each control system spring device whose failure could cause flutter or other unsafe characteristics must be reliable.

(b) Compliance with paragraph (a) of this section must be shown by tests simulating service conditions.

527.691 *Autorotation Control Mechanism*

Each main rotor blade pitch control mechanism must allow rapid entry into autorotation after power failure.

527.695 *Power Boost and Power-Operated Control System*

(a) If a power boost or power-operated control system is used, an alternate system must be immediately available that allows continued safe flight and landing in the event of:

(1) Any single failure in the power portion of the system; or

(2) The failure of all engines.

(b) Each alternate system may be a duplicate power portion or a manually operated mechanical system. The power portion includes the power source (such as hydraulic pumps), and such items as valves, lines, and actuators.

(c) The failure of mechanical parts (such as piston rods and links), and the jamming of power cylinders, must be considered unless they are extremely improbable.

Landing Gear

527.723 *Shock Absorption Tests*

The landing inertia load factor and the reserve energy absorption capacity of the landing gear must be substantiated by the tests prescribed in 527.725 and 527.727, respectively. These tests must be conducted on the complete rotorcraft or on units consisting of wheel, tire, and shock absorber in their proper relation.

527.725 *Limit Drop Test*

The limit drop test must be conducted as follows:

(a) The drop height must be:

(1) 13 inches from the lowest point of the landing gear to the ground; or

(2) Any lesser height, not less than 8 inches, resulting in a drop contact velocity equal to the greatest probable sinking speed likely to occur at ground contact in normal power-off landings.

(b) If considered, the rotor lift specified in 527.473 (a) must be introduced into the drop test by appropriate energy absorbing devices or by the use of an effective mass.

(c) Each landing gear unit must be tested in the attitude simulating the landing condition that is most critical from the standpoint of the energy to be absorbed by it.

(d) When an effective mass is used in showing compliance with paragraph (b) of this section, the following formula may be used instead of more rational computations:

$$W_e = W\left(\frac{h+(1-L)d}{h+d}\right) \quad \text{and} \quad n = n_j\,\frac{W_e}{W} + L$$

where:

W_e = the effective weight to be used in the drop test (lbs.);

$W = W_M$ for main gear units (lbs.), equal to the static reaction on the particular unit with the rotorcraft in the most critical attitude. A rational method may be used in computing a main gear static reaction, taking into consideration the moment arm between the main wheel reaction and the rotorcraft centre of gravity.

$W = W_N$ for nose gear units (lbs.), equal to the vertical component of the static reaction that would exist at the nose wheel, assuming that the mass of the rotorcraft acts at the centre of gravity and exerts a force of 1.0g downward and 0.25 g forward.

$W = W_T$ for tailwheel units (lbs.), equal to whichever of the following is critical:

(1) The static weight on the tailwheel with the rotorcraft resting on all wheels; or

(2) The vertical component of the ground reaction that would occur at the tailwheel, assuming that the mass of the rotorcraft acts at the centre of gravity and exerts a force of 1g downward with the rotorcraft in the maximum nose-up attitude considered in the nose-up landing conditions.

h = specified free drop height (inches).

L = ratio of assumed rotor lift to the rotorcraft weight.

d = deflection under impact of the tire (at the proper inflation pressure) plus the vertical component of the axle travels (inches) relative to the drop mass.

n = limit inertia load factor.

n_j = the load factor developed, during impact, on the mass used in the drop test (i.e., the acceleration dv/dt in g's recorded in the drop test plus 1.0).

527.727 *Reserve Energy Absorption Drop Test*

The reserve energy absorption drop test must be conducted as follows:

(a) The drop height must be 1.5 times that specified in 527.725(a).

(b) Rotor lift, where considered in a manner similar to that prescribed in 527.725 (b), may not exceed 1.5 times the lift allowed under that paragraph.

(c) The landing gear must withstand this test without collapsing. Collapse of the landing gear occurs when a member of the nose, tail, or main gear will not support the rotorcraft in the proper attitude or allows the rotorcraft structure, other than the landing gear and external accessories, to impact the landing surface.

(Change 527-2 (92-02-01))

527.729 *Retracting Mechanism*

For rotorcraft with retractable landing gear, the following apply:

(a) Loads. The landing gear, retracting mechanism, wheel-well doors, and supporting structure must be designed for:

(1) The loads occurring in any manoeuvring condition with the gear retracted;

(2) The combined friction, inertia, and air loads occurring during retraction and extension at any airspeed up to the design maximum landing gear operating speed; and

(3) The flight loads, including those in yawed flight, occurring with the gear extended at any airspeed up to the design maximum landing ear extended speed.

(b) Landing gear lock. A positive means must be provided to keep the gear extended.

(c) Emergency operation. When other than manual power is used to operate the gear, emergency means must be provided for extending the gear in the event of:

(1) Any reasonably probable failure in the normal retraction system; or

(2) The failure of any single source of hydraulic, electric, or equivalent energy.

(d) Operation tests. The proper functioning of the retracting mechanism must be shown by operation tests.

(e) Position indicator. There must be a means to indicate to the pilot when the gear is secured in the extreme positions.

(f) Control. The location and operation of the retraction control must meet the requirements of 527.777 and 527.779.

(g) Landing gear warning. An aural or equally effective landing gear warning device must be provided that functions continuously when the rotorcraft is in a normal landing mode and the landing gear is not fully extended and locked. A manual shut-off capability must be provided for the warning device and the warning system must automatically reset when the rotorcraft is no longer in the landing mode.

527.731 *Wheels*

(a) Each landing gear wheel must be approved.

(b) The maximum static load rating of each wheel may not be less than the corresponding static ground reaction with:

(1) Maximum weight; and

(2) Critical centre of gravity.

(c) The maximum limit load rating of each wheel must equal or exceed the maximum radial limit load determined under the applicable ground load requirements of this chapter.

527.733 *Tires*

(a) Each landing gear wheel must have a tire:

(1) That is a proper fit on the rim of the wheel; and

(2) Of the proper rating.

(b) The maximum static load rating of each tire must equal or exceed the static ground reaction obtained at its wheel, assuming:

(1) The design maximum weight; and

(2) The most unfavourable centre of gravity.

(c) Each tire installed on a retractable landing gear system must, at the maximum size of the tire type expected in service, have a clearance to surrounding structure and systems that is adequate to prevent contact between the tire and any part of the structure or systems.

527.735 *Brakes*

For rotorcraft with wheel-type landing gear, a braking device must be installed that is:

(a) Controllable by the pilot;

(b) Usable during power-off landings; and

(c) Adequate to:

(1) Counteract any normal unbalanced torque when starting or stopping the rotor; and

(2) Hold the rotorcraft parked on a 10° slope on a dry, smooth pavement.

527.737 *Skis*

The maximum limit load rating of each ski must equal or exceed the maximum limit load determined under the applicable ground load requirements of this chapter.

Floats and Hulls

527.751 *Main Float Buoyancy*

(a) For main floats, the buoyancy necessary to support the maximum weight of the rotorcraft in fresh water must be exceeded by:

(1) 50 percent, for single floats; and

(2) 60 percent, for multiple floats.

(b) Each main float must have enough water-tight compartments so that, with any single main float compartment flooded, the main floats will provide a margin of positive stability great enough to minimize the probability of capsizing.

527.753 *Main Float Design*

(a) Bag floats. Each bag float must be designed to withstand:

(1) The maximum pressure differential that might be developed at the maximum altitude for which certification with that float is requested; and

(2) The vertical loads prescribed in 527.521 (a), distributed along the length of the bag over three quarters of its projected area.

(b) Rigid floats. Each rigid float must be able to withstand the vertical, horizontal, and side loads prescribed in 527.521. These loads may be distributed along the length of the float.

527.755 *Hulls*

For each rotorcraft, with a hull and auxiliary floats, that is to be approved for both taking off from and landing on water, the hull and auxiliary floats must have enough water-tight compartments so that, with any single compartment flooded, the buoyancy of the hull and auxiliary floats (and wheel tires if used) provides a margin of positive stability great enough to minimize the probability of capsizing.

Personnel and Cargo Accommodations

527.771 *Pilot Compartment*

For each pilot compartment:

(a) The compartment and its equipment must allow each pilot to perform his duties without unreasonable concentration or fatigue;

(b) If there is provision for a second pilot, the rotorcraft must be controllable with equal safety from either pilot seat; and

(c) The vibration and noise characteristics of cockpit appurtenances may not interfere with safe operation.

527.773 *Pilot Compartment View*

(a) Each pilot compartment must be free from glare and reflections that could interfere with the pilot's view, and designed so that:

(1) Each pilot's view is sufficiently extensive, clear, and undistorted for safe operation; and

(2) Each pilot is protected from the elements so that moderate rain conditions do not unduly impair his view of the flight path in normal flight and while landing.

(b) If certification for night operation is requested, compliance with paragraph (a) of this section must be shown in night flight tests.

527.775 *Windshields and Windows*

Windshields and windows must be made of material that will not break into dangerous fragments.

(Change 527-2 (92-02-01))

527.777 *Cockpit Controls*

Cockpit controls must be:

(a) Located to provide convenient operation and to prevent confusion and inadvertent operation; and

(b) Located and arranged with respect to the pilots' seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 5'2" to 6'0" in height are seated.

527.779 *Motion and Effect of Cockpit Controls*

Cockpit controls must be designed so that they operate in accordance with the following movement and actuation:

(a) Flight controls, including the collective pitch control, must operate with a sense of motion which corresponds to the effect on the rotorcraft.

(b) Twist-grip engine power controls must be designed so that, for left hand operation, the motion of the pilot's hand is clockwise to increase power when the hand is viewed from the edge containing the index finger. Other engine power controls, excluding the collective control, must operate with a forward motion to increase power.

(c) Normal landing gear controls must operate downward to extend the landing gear.

527.783 *Doors*

(a) Each closed cabin must have at least one adequate and easily accessible external door.

(b) Each external door must be located where persons using it will not be endangered by the rotors, propellers, engine intakes, and exhausts when appropriate operating procedures are used. If opening procedures are required, they must be marked inside, on or adjacent to the door opening device.

(Change 527-2 (92-02-01))

527.785 *Seats, Berths,Litters, Safety Belts, and Harnesses*

(a) Each seat, safety belt, harness, and adjacent part of the rotorcraft, at each station designated for occupancy during takeoff and landing, must be free of potentially injurious objects, sharp edges, protuberances, and hard surfaces, and must be designed so that a

person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the static inertial load factors specified in 527.561 (b) and dynamic conditions specified in 527.562.

(b) Each occupant must be protected from serious head injury by a safety belt plus a shoulder harness that will prevent the head from contacting any injurious object except as provided for in 527.562 (c)(5). A shoulder harness (upper torso restraint), in combination with the safety belt, constitutes a torso restraint system as described in *TSO-C114*.

(c) Each occupant's seat must have a combined safety belt and shoulder harness with a single-point release. Each pilot's combined safety belt and shoulder harness must allow each pilot when seated with safety belt and shoulder harness fastened to perform all functions necessary for flight operations. There must be a means to secure belts and harnesses, when not in use, to prevent interference with the operation of the rotorcraft and with rapid egress in an emergency.

(d) If seat backs do not have a firm handhold, there must be hand grips or rails along each aisle to enable the occupants to steady themselves while using the aisle in moderately rough air.

(e) Each projecting object that could injure persons seated or moving about in the rotorcraft in normal flight must be padded.

(f) Each seat and its supporting structure must be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertial forces, and reactions between occupant, seat, and safety belt or harness corresponding with the applicable flight and ground-load conditions, including the emergency landing conditions of 527.561(b). In addition:

(1) Each pilot seat must be designed for the reactions resulting from the application of the pilot forces prescribed in 527.397; and

(2) The inertial forces prescribed in 527.561 (b) must be multiplied by a factor of 1.33 in determining the strength of the attachment of:

(i) Each seat to the structure; and

(ii) Each safety belt or harness to the seat or structure.

(g) When the safety belt and shoulder harness are combined, the rated strength of the safety belt and shoulder harness may not be less than that corresponding to the inertial forces specified in 527.561 (b), considering the occupant weight of at least 170 pounds, considering the dimensional characteristics of the restraint system installation, and using a distribution of at least 60 percent load to the safety belt and at least a 40 percent load to the shoulder harness. If the safety belt is capable of being used without the shoulder harness, the inertial forces specified must be met by the safety belt alone.

(h) When a headrest is used, the headrest and its supporting structure must be designed to resist the inertia forces specified in 527.561, with a 1.33 fitting factor and a head weight of at least 13 pounds.

(i) Each seating device system includes the device such as the seat, the cushions, the occupant restraint system, and attachment devices.

(j) Each seating device system may use design features such as crushing or separation of certain parts of the seats to reduce occupant loads for the emergency landing dynamic conditions of 527.562; otherwise, the system must remain intact and must not interfere with rapid evacuation of the rotorcraft.

(k) For the purposes of this section, a litter is defined as a device designed to carry a non-ambulatory person, primarily in a recumbent position, into and on the rotorcraft. Each berth or litter must be designed to withstand the load reaction of an occupant weight of at least 170 pounds when the occupant is subjected to the forward inertial factors specified in 527.561 (b). A berth or litter installed within 15° or less of the longitudinal axis of the rotorcraft must be provided with a padded end-board, cloth diaphragm, or equivalent means that can withstand the forward load reaction. A berth or litter oriented greater than 15° with the longitudinal axis of the rotorcraft must be equipped with appropriate restraints, such as straps or safety belts, to withstand the forward load reaction. In addition:

(1) The berth or litter must have a restraint system and must not have corners or other protuberances likely to cause serious injury to a person occupying it during emergency landing condition; and

(2) The berth or litter attachment and the occupant restraint system attachments to the structure must be designed to withstand the critical loads resulting from flight and ground load conditions and from the conditions prescribed in 527.561 (b). The fitting factor required by 527.625 (d) shall be applied.

(Change 527-2 (92-02-01))

(Change 527-4)

527.787 *Cargo and Baggage Compartments*

(a) Each cargo and baggage compartment must be designed for its placarded maximum weight of contents and for the critical load distributions at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, except the emergency landing conditions of 527.561.

(b) There must be means to prevent the contents of any compartment from becoming a hazard by shifting under the loads specified in paragraph (a) of this section.

(c) Under the emergency landing conditions of 527.561, cargo and baggage compartments must:

(1) Be positioned so that if the contents break loose they are unlikely to cause injury to the occupants or restrict any of the escape facilities provided for use after an emergency landing; or

(2) Have sufficient strength to withstand the conditions specified in 527.561 including the means of restraint, and their attachments, required by paragraph (b) of this section. Sufficient strength must be provided for the maximum authorized weight of cargo and baggage at the critical loading distribution.

(d) If cargo compartment lamps are installed, each lamp must be installed so as to prevent contact between lamp bulb and cargo.

(Change 527-2 (92-02-01))

527.801 *Ditching*

(a) If certification with ditching provisions is requested, the rotorcraft must meet the requirements of this section and 527.807 (d), 527.1411 and 527.1415.

(b) Each practicable design measure, compatible with the general characteristics of the rotorcraft, must be taken to minimize the probability that in an emergency landing on water, the behaviour of the rotorcraft would cause immediate injury to the occupants or would make it impossible for them to escape.

(c) The probable behaviour of the rotorcraft in a water landing must be investigated by model tests or by comparison with rotorcraft of similar configuration for which the ditching characteristics are known. Scoops, flaps, projections, and any other factor likely to affect the hydrodynamic characteristics of the rotorcraft must be considered.

(d) It must be shown that, under reasonably probable water conditions, the flotation time and trim of the rotorcraft will allow the occupants to leave the rotorcraft and enter the life rafts required by 527.1415. If compliance with this provision is shown by buoyancy and trim computations, appropriate allowances must be made for probable structural damage and leakage. If the rotorcraft has fuel tanks (with fuel jettisoning provisions) that can reasonably be expected to withstand a ditching without leakage, the jettisonable volume of fuel may be considered as buoyancy volume.

(e) Unless the effects of the collapse of external doors and windows are accounted for in the investigation of the probable behaviour of the rotorcraft in a water landing (as prescribed in paragraphs (c) and (d) of this section), the external doors and windows must be designed to withstand the probable maximum local pressures.

527.805 *Flight Crew Emergency Exits*

(a) For rotorcraft with passenger emergency exits that are not convenient to the flight crew, there must be flight crew emergency exits, on both sides of the rotorcraft or as a top hatch in the flight crew area.

(b) Each flight crew emergency exit must be of sufficient size and must be located so as to allow rapid evacuation of the flight crew. This must be shown by test.

(c) Each flight crew emergency exit must not be obstructed by water or flotation devices after an emergency landing on water. This must be shown by test, demonstration, or analysis.

(Change 527-4)

527.807 *Emergency Exits*

(a) Number and Location.

(1) There must be at least one emergency exit on each side of the cabin readily accessible

to each passenger. One of these exits must be usable in any probable attitude that may result from a crash;

(2) Doors intended for normal use may also serve as emergency exits, provided that they meet the requirements of this section; and

(3) If emergency flotation devices are installed, there must be an emergency exit accessible to each passenger on each side of the cabin that is shown by test, demonstration, or analysis to:

(i) Be above the waterline; and

(ii) Open without interference from flotation devices, whether stowed or deployed.

(b) Type and operation. Each emergency exit prescribed by paragraph (a) of this section must:

(1) Consist of a movable window or panel, or additional external door, providing an unobstructed opening that will admit a 19 by 26-inch ellipse;

(2) Have simple and obvious methods of opening, from the inside and from the outside, which do not require exceptional effort;

(3) Be arranged and marked so as to be readily located and opened even in darkness; and

(4) Be reasonably protected from jamming by fuselage deformation.

(c) Tests. The proper functioning of each emergency exit must be shown by test.

(d) Ditching emergency exits for passengers. If certification with ditching provisions is requested, the markings required by paragraph (b)(3) of this section must be designed to remain visible if the rotorcraft is capsized and the cabin is submerged.

(Change 527-2 (92-02-01))

(Change 527-4)

527.831 *Ventilation*

(a) The ventilating system for the pilot and passenger compartments must be designed to prevent the presence of excessive quantities of fuel fumes and carbon monoxide.

(b) The concentration of carbon monoxide may not exceed one part in 20,000 parts of air during forward flight or hovering in still air. If the concentration exceeds this value under other conditions, there must be suitable operating restrictions.

527.833 *Heaters*

Each combustion heater must be approved.

(Change 527-1 (89-01-01))

Fire Protection

527.853 *Compartment Interiors*

For each compartment to be used by the crew or passengers:

(a) The materials must be at least flame resistant;

(b) Removed and Reserved;

(c) If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed:

(1) There must be an adequate number of self-contained, removable ashtrays; and

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one illuminated sign (using either letters or symbols) notifying all passengers when smoking is prohibited. Signs which notify when smoking is prohibited must:

(i) When illuminated, be legible to each passenger seated in the passenger cabin under all probable lighting conditions; and

(ii) Be so constructed that the crew can turn the illumination on and off.

(Change 527-4)

527.855 *Cargo and Baggage Compartments*

(a) Each cargo and baggage compartment must be constructed of, or lined with, materials that are at least:

(1) Flame resistant, in the case of compartments that are readily accessible to a crew member in flight; and

(2) Fire resistant, in the case of other compartments.

(b) No compartment may contain any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operation, unless those items are protected so that:

(1) They cannot be damaged by the movement of cargo in the compartment; and

(2) Their breakage or failure will not create a fire hazard.

527.859 *Heating Systems*

(a) General. For each heating system that involves the passage of cabin air over, or close to, the exhaust manifold, there must be means to prevent carbon monoxide from entering any cabin or pilot compartment.

(b) Heat exchangers. Each heat exchanger must be:

(1) Of suitable materials;

(2) Adequately cooled under all conditions; and

(3) Easily disassembled for inspection.

(c) Combustion heater fire protection. Except for heaters which incorporate designs to prevent hazards in the event of fuel leakage in the heater fuel system, fire within the ventilating air passage, or any other heater malfunction, each heater zone must incorporate

the fire protection features of the applicable requirements of 527.1183, 527.1185, 527.1189, 527.1191, and be provided with:

(1) Approved, quick-acting fire detectors in numbers and locations ensuring prompt detection of fire in the heater region.

(2) Fire extinguisher systems that provide at least one adequate discharge to all areas of the heater region.

(3) Complete drainage of each part of each zone to minimize the hazards resulting from failure or malfunction of any component containing flammable fluids. The drainage means must be:

(i) Effective under conditions expected to prevail when drainage is needed; and

(ii) Arranged so that no discharged fluid will cause an additional fire hazard.

(4) Ventilation, arranged so that no discharged vapours will cause an additional fire hazard.

(d) Ventilating air ducts. Each ventilating air duct passing through any heater region must be fireproof.

(1) Unless isolation is provided by fireproof valves or by equally effective means, the ventilating air duct downstream of each heater must be fireproof for a distance great enough to ensure that any fire originating in the heater can be contained in the duct.

(2) Each part of any ventilating duct passing through any region having a flammable fluid system must be so constructed or isolated from that system that the malfunctioning of any component of that system cannot introduce flammable fluids or vapours into the ventilating airstream.

(e) Combustion air ducts. Each combustion air duct must be fireproof for a distance great enough to prevent damage from backfiring or reverse flame propagation.

(1) No combustion air duct may connect with the ventilating airstream unless flames from backfires or reverse burning cannot enter the ventilating air-stream under any operating condition, including reverse flow or malfunction of the heater or its associated components.

(2) No combustion air duct may restrict the prompt relief of any backfire that, if so restricted, could cause heater failure.

(f) Heater control: General. There must be means to prevent the hazardous accumulation of water or ice on or in any heater control component, control system tubing, or safety control.

(g) Heater safety controls. For each combustion heater, safety control means must be provided as follows:

(1) Means independent of the components provided for the normal continuous control of air temperature, airflow, and fuel flow must be provided for each heater to automatically shut off the ignition and fuel supply of that heater at a point remote from that heater when any of the following occurs:

(i) The heat exchanger temperature exceeds safe limits.

(ii) The ventilating air temperature exceeds safe limits.

(iii) The combustion airflow becomes inadequate for safe operation.

(iv) The ventilating airflow becomes inadequate for safe operation.

(2) The means of complying with paragraph (g)(1) of this section for any individual heater must:

(i) Be independent of components serving any other heater, the heat output of which is essential for safe operation; and

(ii) Keep the heater off until restarted by the crew.

(3) There must be means to warn the crew when any heater, the heat output of which is essential for safe operation, has been shut off by the automatic means prescribed in paragraph (g)(1) of this section.

(h) Air intakes. Each combustion and ventilating air intake must be located so that no flammable fluids or vapours can enter the heater system:

(1) During normal operation; or

(2) As a result of the malfunction of any other component.

(i) Heater exhaust. Each heater exhaust system must meet the requirements of 527.1121 and 527.1123.

(1) Each exhaust shroud must be sealed so that no flammable fluids or hazardous quantities of vapours can reach the exhaust system through joints.

(2) No exhaust system may restrict the prompt relief of any backfire that, if so restricted, could cause heater failure.

(j) Heater fuel systems. Each heater fuel system must meet the powerplant fuel system requirements affecting safe heater operation. Each heater fuel system component in the ventilating airstream must be protected by shrouds so that no leakage from those components can enter the ventilating airstream.

(k) Drains. There must be means for safe drainage of any fuel that might accumulate in the combustion chamber or the heat exchanger.

(1) Each part of any drain that operates at high temperatures must be protected in the same manner as heater exhausts.

(2) Each drain must be protected against hazardous ice accumulation under any operating condition.

(Change 527-1 (89-01-01))

527.861 *Fire Protection of Structure, Controls, and Other Parts*

Each part of the structure, controls, rotor mechanism, and other parts essential to a

controlled landing that would be affected by powerplant fires must be fireproof or protected so that they can perform their essential functions for at least 5 minutes under any foreseeable powerplant fire condition.

(Change 527-2 (92-02-01))

527.863 *Flammable Fluid Fire Protection*

(a) In each area where flammable fluids or vapours might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapours, and the resultant hazards if ignition does occur.

(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage.

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials.

(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices.

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents.

(5) Ability of rotorcraft components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g. equipment shutdown or actuation of a fire extinguisher) quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapour might escape by leakage of a fluid system must be identified and defined.

External Loads

527.865 External Loads

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for non-human external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under 527.337 through 527.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under 527.337 through 527.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction

making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if:

(1) An operating limitation is established limiting external load operations to such angles for which compliance with this paragraph has been shown; or

(2) It is shown that the lesser angle can not be exceeded in service.

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick-release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crew member without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must:

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external limit load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for non-human external cargo is a radio frequency field strength of 20 volts per metre.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per metre.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must:

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) of this section and that:

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem;

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety;

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, the ingress and egress instructions;

(4) Have equipment to allow direct intercommunication among required crew members and external occupants; and

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under 527.25 and this section.

(f) The fatigue evaluation of 527.571 of this chapter does not apply to rotorcraft-load combinations to be used for non-human external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of 527.571 of this chapter applies to the entire quick release and personnel carrying device structural systems and their attachments.

(Change 527-2 (92-02-01))

(Change 527-4)

Miscellaneous

527.871 *Levelling Marks*

There must be reference marks for levelling the rotorcraft on the ground.

527.873 *Ballast Provisions*

Ballast provisions must be designed and constructed to prevent inadvertent shifting of ballast in flight.

SUBCHAPTER E
POWERPLANT - GENERAL

527.901 *Installation*

(a) For the purpose of this chapter, the powerplant installation includes each part of the rotorcraft (other than the main and auxiliary rotor structures) that:

(1) Is necessary for propulsion;

(2) Affects the control of the major propulsive units; or

(3) Affects the safety of the major propulsive units between normal inspections or overhauls.

(b) For each powerplant installation:

(1) Each component of the installation must be constructed, arranged, and installed to ensure its continued safe operation between normal inspections or overhauls for the range of temperature and altitude for which approval is requested;

(2) Accessibility must be provided to allow any inspection and maintenance necessary for continued airworthiness;

(3) Electrical interconnections must be provided to prevent differences of potential between major components of the installation and the rest of the rotorcraft;

(4) Axial and radial expansion of turbine engines may not affect the safety of the installation; and

(5) Design precautions must be taken to minimize the possibility of incorrect assembly of components and equipment essential to safe operation of the rotorcraft, except where operation with the incorrect assembly can be shown to be extremely improbable.

(c) The installation must comply with:

(1) The installation instructions provided under 533.5 of this manual, and

(2) The applicable provisions of this subchapter.

(Change 527-1 (89-01-01))

527.903 *Engines*

(a) Engine type certification. Each engine must have an approved type certificate. Reciprocating engines for use in helicopters must be qualified in accordance with 533.49 (d) of this manual or be otherwise approved for the intended usage.

(b) Engine or drive system cooling fan blade protection.

(1) If an engine or rotor drive system cooling fan is installed, there must be a means to protect the rotorcraft and allow a safe landing if a fan blade fails. This must be shown by showing that:

(i) The fan blades are contained in case of failure;

(ii) Each fan is located so that a failure will not jeopardize safety; or

(iii) Each fan blade can withstand an ultimate load of 1.5 times the centrifugal force resulting from operation limited by the following:

(A) For fans driven directly by the engine:

(1) The terminal engine r.p.m. under uncontrolled conditions; or

(2) An overspeed limiting device.

(B) For fans driven by the rotor drive system, the maximum rotor drive system

rotational speed to be expected in service, including transients.

(2) Unless a fatigue evaluation under 527.571 is conducted, it must be shown that cooling fan blades are not operating at resonant conditions within the operating limits of the rotorcraft.

(c) Turbine engine installation. For turbine engine installations, the powerplant systems associated with engine control devices, systems, and instrumentation must be designed to give reasonable assurance that those engine operating limitations that adversely affect turbine rotor structural integrity will not be exceeded in service.

(d) Restart capability: A means to restart any engine in flight must be provided.
(amended 2009/05/11)

(1) Except for the in-flight shutdown of all engines, engine restart capability must be demonstrated throughout a flight envelope for the rotorcraft.
(amended 2009/05/11)

(2) Following the in-flight shutdown of all engines, in-flight engine restart capability must be provided.
(amended 2009/05/11)

(Change 527-1 (89-01-01))

527.907 *Engine Vibration*

(a) Each engine must be installed to prevent the harmful vibration of any part of the engine or rotorcraft.

(b) The addition of the rotor and the rotor drive system to the engine may not subject the principal rotating parts of the engine to excessive vibration stresses. This must be shown by a vibration investigation.

(c) No part of the rotor drive system may be subjected to excessive vibration stresses.

Rotor Drive System

527.917 *Design*

(a) Each rotor drive system must incorporate a unit for each engine to automatically disengage that engine from the main and auxiliary rotors if that engine fails.

(b) Each rotor drive system must be arranged so that each rotor necessary for control in autorotation will continue to be driven by the main rotors after disengagement of the engine from the main and auxiliary rotors.

(c) If a torque limiting device is used in the rotor drive system, it must be located so as to allow continued control of the rotorcraft when the device is operating.

(d) The rotor drive system includes any part necessary to transmit power from the engines to the rotor hubs. This includes gear boxes, shafting, universal joints, couplings, rotor brake assemblies, clutches, supporting bearings for shafting, any attendant accessory pads or

drives, and any cooling fans that are a part of, attached to, or mounted on the rotor drive system.

527.921 *Rotor Brake*

If there is a means to control the rotation of the rotor drive system independently of the engine, any limitations on the use of that means must be specified, and the control for that means must be guarded to prevent inadvertent operation.

527.923 *Rotor Drive System and Control Mechanism Tests*

(a) Each part tested as prescribed in this section must be in a serviceable condition at the end of the tests. No intervening disassembly which might affect test results may be conducted.

(b) Each rotor drive system and control mechanism must be tested for not less than 100 hours. The test must be conducted on the rotorcraft, and the torque must be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of torque absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

(c) A 60-hour part of the test prescribed in paragraph (b) of this section must be run at not less than maximum continuous torque and the maximum speed for use with maximum continuous torque. In this test, the main rotor controls must be set in the position that will give maximum longitudinal cyclic pitch change to simulate forward flight. The auxiliary rotor controls must be in the position for normal operation under the conditions of the test.

(d) A 30-hour or, for rotorcraft for which the use of either 30-minute OEI power or continuous OEI power is requested, a 25-hour part of the test prescribed in paragraph (b) of this section must be run at not less than 75 percent of maximum continuous torque and the minimum speed for use with 75 percent of maximum continuous torque. The main and auxiliary rotor controls must be in the position for normal operation under the conditions of the test.

(e) A 10-hour part of the test prescribed in paragraph (b) of this section must be run at not less than take-off torque and the maximum speed for use with take-off torque. The main and auxiliary rotor controls must be in the normal position for vertical ascent.

(1) For multi-engine rotorcraft for which the use of 2½ minute OEI power is requested, 12 runs during the 10-hour test must be conducted as follows:

(i) Each run must consist of at least one period of 2½ minutes with take-off torque and the maximum speed for use with take-off torque on all engines.

(ii) Each run must consist of at least one period for each engine in sequence, during which that engine simulates a power failure and the remaining engines are run at 2½ minute OEI torque and the maximum speed for use with 2½ minute OEI torque for 2½ minutes.

(2) For multi-engine turbine-powered rotorcraft for which the use of 30-second and 2-minute OEI power is requested, 10 runs must be conducted as follows:

(i) Immediately following a take-off run of at least 5 minutes, each power source must simulate a failure, in turn, and apply the maximum torque and the maximum speed for use with 30-second OEI power to the remaining affected drive system power inputs for not less than 30 seconds, followed by application of the maximum torque and the maximum speed for use with 2-minute OEI power for not less than 2 minutes. At least one run sequence must be conducted from a simulated "flight idle" condition. When conducted on a bench test, the test sequence must be conducted following stabilization at takeoff power.

(ii) For the purpose of this paragraph, an affected power input includes all parts of the rotor drive system which can be adversely affected by the application of higher or asymmetric torque and speed prescribed by the test.

(iii) This test may be conducted on a representative bench test facility when engine limitations either preclude repeated use of this power or would result in premature engine removal during the test. The loads, the vibration frequency, and the methods of application to the affected rotor drive system components must be representative of rotorcraft conditions. Test components must be those used to show compliance with the remainder of this section.

(f) The parts of the test prescribed in paragraphs (c) and (d) of this section must be conducted in intervals of not less than 30 minutes and may be accomplished either on the ground or in flight. The part of the test prescribed in paragraph (e) of this section must be conducted in intervals of not less than 5 minutes.

(g) At intervals of not more than 5 hours during the tests prescribed in paragraphs (c), (d), and (e) of this section, the engine must be stopped rapidly enough to allow the engine and rotor drive to be automatically disengaged from the rotors.

(h) Under the operating conditions specified in paragraph (c) of this section, 500 complete cycles of lateral control, 500 complete cycles of longitudinal control of the main rotors, and 500 complete cycles of control of each auxiliary rotor must be accomplished. A "complete cycle" involves movement of the controls from the neutral position, through both extreme positions, and back to the neutral position, except that control movements need not produce loads or flapping motions exceeding the maximum loads or motions encountered in flight. The cycling may be accomplished during the testing prescribed in paragraph (c) of this section.

(i) At least 200 start-up clutch engagements must be accomplished:

(1) So that the shaft on the driven side of the clutch is accelerated; and

(2) Using a speed and method selected by the applicant.

(j) For multi-engine rotorcraft for which the use of 30-minute OEI power is requested, five runs must be made at 30-minute OEI torque and the maximum speed for use with 30-minute OEI torque, in which each engine, in sequence, is made inoperative and the remaining engine(s) is run for a 30-minute period.

(k) For multi-engine rotorcraft for which the use of continuous OEI power is requested, five runs must be made at continuous OEI torque and the maximum speed for use with continuous OEI torque, in which each engine, in sequence, is made inoperative and the remaining engine(s) is run for a 1-hour period.

(Change 527-1 (89-01-01))

(Change 527-4)

527.927 *Additional Tests*

(a) Any additional dynamic, endurance, and operational tests, and vibratory investigations necessary to determine that the rotor drive mechanism is safe, must be performed.

(b) If turbine engine torque output to the transmission can exceed the highest engine or transmission torque rating limit, and that output is not directly controlled by the pilot under normal operating conditions (such as where the primary engine power control is accomplished through the flight control), the following test must be made:

(1) Under conditions associated with all engines operating, make 200 applications, for 10 seconds each, or torque that is at least equal to the lesser of:

(i) The maximum torque used in meeting 527.923 plus 10 percent; or

(ii) The maximum attainable torque output of the engines, assuming that torque limiting devices, if any, function properly.

(2) For multi-engine rotorcraft under conditions associated with each engine, in turn, becoming inoperative, apply to the remaining transmission torque inputs the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly. Each transmission input must be tested at this maximum torque for at least 15 minutes.

(3) The tests prescribed in this paragraph must be conducted on the rotorcraft at the maximum rotational speed intended for the power condition of the test and the torque must be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of torque absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

(c) It must be shown by tests that the rotor drive system is capable of operating under autorotative conditions for 15 minutes after the loss of pressure in the rotor drive primary oil system.

(Change 527-1 (89-01-01))

527.931 *Shafting Critical Speed*

(a) The critical speeds of any shafting must be determined by demonstration, except that analytical methods may be used if reliable methods of analysis are available for the particular design.

(b) If any critical speed lies within, or close to, the operating ranges for idling, power on, and autorotative conditions, the stresses occurring at that speed must be within safe limits. This must be shown by tests.

(c) If analytical methods are used and show that no critical speed lies within the permissible operating ranges, the margins between the calculated critical speeds and the limits of the allowable operating ranges must be adequate to allow for possible variations between the computed and actual values.

527.935 *Shafting Joints*

Each universal joint, slip joint, and other shafting joint whose lubrication is necessary for operation must have provision for lubrication.

527.939 *Turbine Engine Operating Characteristics*

(a) Turbine engine operating characteristics must be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flame-out) are present, to a hazardous degree, during normal and emergency operation within the range of operating limitations of the rotorcraft and of the engine.

(b) The turbine engine air inlet system may not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

(c) For governor-controlled engines, it must be shown that there exists no hazardous torsional instability of the drive system associated with critical combinations of power, rotational speed, and control displacement.

Fuel System

527.951 *General*

(a) Each fuel system must be constructed and arranged to ensure a flow of fuel at a rate and pressure established for proper engine functioning under any likely operating condition, including the manoeuvres for which certification is requested.

(b) Each fuel system must be arranged so that:

(1) No fuel pump can draw fuel from more than one tank at a time; or

(2) There are means to prevent introducing air into the system.

(c) Each fuel system for a turbine engine must be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 80°F and having 0.75cc of free water per gallon (3.785 litres) added and cooled to the most critical condition for icing likely to be encountered in operation.

527.952 *Fuel System Crash Resistance*

Unless other means acceptable to the Minister are employed to minimize the hazard of fuel fires to occupants following an otherwise survivable impact (crash landing), the fuel systems

must incorporate the design features of this section. These systems must be shown to be capable of sustaining the static and dynamic deceleration loads of this section, considered as ultimate loads acting alone, measured at the system component's centre of gravity, without structural damage to system components, fuel tanks, or their attachments that would leak fuel to an ignition source.

(a) Drop test requirements. Each tank, or the most critical tank, must be drop-tested as follows:

(1) The drop height must be at least 50 feet.

(2) The drop impact surface must be non-deforming.

(3) The tank must be filled with water to 80 percent of the normal, full capacity.

(4) The tank must be enclosed in a surrounding structure representative of the installation unless it can be established that the surrounding structure is free of projections or other design features likely to contribute to rupture of the tank.

(5) The tank must drop freely and impact in a horizontal position ±10º.

(6) After the drop test, there must be no leakage.

(b) Fuel tank load factors. Except for fuel tanks located so that tank rupture with fuel release to either significant ignition sources, such as engines, heaters, and auxiliary power units, or occupants is extremely remote, each fuel tank must be designed and installed to retain its contents under the following ultimate inertial load factors, acting alone.

(1) For fuel tanks in the cabin:

(i) Upward - 4g.

(ii) Forward - 16g.

(iii) Sideward - 8g.

(iv) Downward - 20g.

(2) For fuel tanks located above or behind the crew or passenger compartment that, if loosened, could injure an occupant in an emergency landing:

(i) Upward - 1.5g

(ii) Forward - 8g.

(iii) Sideward - 2g.

(iv) Downward - 4g.

(3) For fuel tanks in other areas:

(i) Upward - 1.5g

(ii) Forward - 4g.

(iii) Sideward - 2g.

(iv) Downward - 4g.

(c) Fuel line self-sealing breakaway couplings. Self-sealing breakaway couplings must be installed unless hazardous relative motion of fuel system components to each other or to local rotorcraft structure is demonstrated to be extremely improbable or unless other means are provided. The couplings or equivalent devices must be installed at all fuel tank-to-fuel line connections, tank-to-tank interconnects, and at other points in the fuel system where local structural deformation could lead to release to fuel.

(1) The design and construction of self-sealing breakaway couplings must incorporate the following design features:

(i) The load necessary to separate a breakaway coupling must be between 25 to 50 percent of the minimum ultimate failure load (ultimate strength) of the weakest component in the fluid-carrying line. The separation load must in no case be less than 300 pounds, regardless of the size of the fluid line.

(ii) A breakaway coupling must separate whenever its ultimate load (as defined in paragraph (c)(1)(i) of this section) is applied in the failure modes most likely to occur.

(iii) All breakaway couplings must incorporate design provisions to visually ascertain that the coupling is locked together (leak-free) and is open during normal installation and service.

(iv) All breakaway couplings must incorporate design provisions to prevent uncoupling or unintended closing due to operational shocks, vibrations, or accelerations.

(v) No breakaway coupling design may allow the release of fuel once the coupling has performed its intended function.

(2) All individual breakaway couplings, coupling fuel feed systems, or equivalent means must be designed, tested, installed, and maintained so that inadvertent fuel shut-off in flight is improbable in accordance with 527.955 (a) and must comply with the fatigue evaluation requirements of 527.571 without leaking.

(3) Alternate, equivalent means to the use of breakaway couplings must not create a survivable impact-induced load on the fuel line to which it is installed greater than 25 to 50 percent of the ultimate load (strength) of the weakest component in the line and must comply with the fatigue requirements of 527.571 without leaking.

(d) Frangible or deformable structural attachments. Unless hazardous relative motion of fuel tanks and fuel system components to local rotorcraft structure is demonstrated to be extremely improbable in an otherwise survivable impact, frangible or locally deformable attachments of fuel tanks and fuel systems components to local rotorcraft structure must be used. The attachment of fuel tanks and fuel system components to local rotorcraft structure, whether frangible or locally deformable, must be designed such that its separation or relative local deformation will occur without rupture of local tear-out of the fuel tank or fuel system components that will cause fuel leakage. The ultimate strength of frangible or deformable attachments must be as follows:

(1) The load required to separate a frangible attachment from its support structure, or deform a locally deformable attachment relative to its support structure, must be between

25 to 50 percent of the minimum ultimate load (ultimate strength) of the weakest component in the attached system. In no case may the load be less than 300 pounds.

(2) A frangible or locally deformable attachment must separate or locally deform as intended whenever its ultimate load (as defined in paragraph (d)(1) of this section) is applied in the modes most likely to occur.

(3) All frangible or locally deformable attachments must comply with the fatigue requirements of 527.571.

(e) Separation of fuel and ignition sources. To provide maximum crash resistance, fuel must be located as far as practicable from all occupiable areas and from all potential ignition sources.

(f) Other basic mechanical design criteria. Fuel tanks, fuel lines, electrical wires, and electrical devices must be designed, constructed, and installed, as far as practicable, to be crash resistant.

(g) Rigid or semi-rigid fuel tanks. Rigid or semi-rigid fuel tank or bladder walls must be impact and tear resistant.

(Change 527-3 (94-01-04))

(Change 527-4)

527.953 *Fuel System Independence*

(a) Each fuel system for multi-engine rotorcraft must allow fuel to be supplied to each engine through a system independent of those parts of each system supplying fuel to other engines. However, separate fuel tanks need not be provided for each engine.

(b) If a single fuel tank is used on a multi-engine rotorcraft, the following must be provided:

(1) Independent tank outlets for each engine, each incorporating a shut-off valve at the tank. This shut-off valve may also serve as the firewall shut-off valve required by 527.995 if the line between the valve and the engine compartment does not contain a hazardous amount of fuel that can drain into the engine compartment.

(2) At least two vents arranged to minimize the probability of both vents becoming obstructed simultaneously.

(3) Filler caps designed to minimize the probability of incorrect installation or in-flight loss.

(4) A fuel system in which those parts of the system from each tank outlet to any engine are independent of each part of each system supplying fuel to other engines.

527.954 *Fuel System Lightning Protection*

The fuel system must be designed and arranged to prevent the ignition of fuel vapour within the system by:

(a) Direct lightning strikes to areas having a high probability of stroke attachment;

(b) Swept lightning strokes to areas where swept strokes are highly probable; or

(c) Corona and streamering at fuel vent outlets.

(Change 527-1 (89-01-01))

527.955 *Fuel Flow*

(a) General. The fuel system for each engine must be shown to provide the engine with at least 100 percent of the fuel required under each operating and manoeuvring condition to be approved for the rotorcraft including, as applicable, the fuel required to operate the engine(s) under the test conditions required by 527.927. Unless equivalent methods are used, compliance must be shown by test during which the following provisions are met except that combinations of conditions which are shown to be improbable need not be considered.

(1) The fuel pressure, corrected for critical accelerations, must be within the limits specified by the engine type certificate data sheet.

(2) The fuel level in the tank may not exceed that established as the unusable fuel supply for that tank under 527.959, plus the minimum additional fuel necessary to conduct the test.

(3) The fuel head between the tank outlet and the engine inlet must be critical with respect to rotorcraft flight attitudes.

(4) The critical fuel pump (for pump-fed systems) is installed to produce (by actual or simulated failure) the critical restriction to fuel flow to be expected from pump failure.

(5) Critical values of engine rotation speed, electrical power, or other sources of fuel pump motive power must be applied.

(6) Critical values of fuel properties which adversely affect fuel flow must be applied.

(7) The fuel filter required by 527.997 must be blocked to the degree necessary to simulate the accumulation of fuel contamination required to activate the indicator required by 527.1305 (q).

(b) Fuel transfer systems. If normal operation of the fuel system requires fuel to be transferred to an engine feed tank, the transfer must occur automatically via a system which has been shown to maintain the fuel level in the engine feed tank within acceptable limits during flight or surface operation of the rotorcraft.

(c) Multiple fuel tanks. If an engine can be supplied with fuel from more than one tank, the fuel systems must, in addition to having appropriate manual switching capability, be designed to prevent interruption of fuel flow to that engine, without attention by the flight crew, when any tank supplying fuel to that engine is depleted of usable fuel during normal operation, and any other tank that normally supplies fuel to the engine alone contains usable fuel.

(Change 527-1 (89-01-01))

527.959 *Unusable Fuel Supply*

The unusable fuel supply for each tank must be established as not less than the quantity at which the first evidence of malfunction occurs under the most adverse fuel feed condition occurring under any intended operations and flight manoeuvres involving that tank.

527.961 *Fuel System Hot Weather Operation*

Each suction lift fuel system and other fuel systems with features conducive to vapour formation must be shown by test to operate satisfactorily (within certification limits) when using fuel at a temperature of 110°F under critical operating conditions including, if applicable, the engine operating conditions defined by 527.927 (b)(1) and (b)(2).

(Change 527-1 (89-01-01))

527.963 *Fuel Tanks:General*

(a) Each fuel tank must be able to withstand, without failure, the vibration, inertia, fluid, and structural loads to which it may be subjected in operation.

(b) Each fuel tank of 10 gallons (37.85 litres) or greater capacity must have internal baffles, or must have external support to resist surging.

(c) Each fuel tank must be separated from the engine compartment by a firewall. At least one-half inch of clear airspace must be provided between the tank and the firewall.

(d) Spaces adjacent to the surfaces of fuel tanks must be ventilated so that fumes cannot accumulate in the tank compartment in case of leakage. If two or more tanks have interconnected outlets, they must be considered as one tank, and the airspaces in those tanks must be interconnected to prevent the flow of fuel from one tank to another as a result of a difference in pressure between those airspaces.

(e) The maximum exposed surface temperature of any component in the fuel tank must be less, by a safe margin as determined by the Minister, than the lowest expected auto-ignition temperature of the fuel or fuel vapour in the tank. Compliance with this requirement must be shown under all operating conditions and under all failure or malfunction conditions of all components inside the tank.

(f) Each fuel tank installed in personnel compartments must be isolated by fume proof and fuel proof enclosures that are drained and vented to the exterior of the rotorcraft. The design and construction of the enclosures must provide necessary protection for the tank, must be crash resistant during a survivable impact in accordance with 527.952, and must be adequate to withstand loads and abrasions to be expected in personnel compartments.

(g) Each flexible fuel tank bladder or liner must be approved or shown to be suitable for the particular application and must be puncture resistant. Puncture resistance must be shown by meeting the TSO-C80, paragraph 16.0, requirements using a minimum puncture force of 370 pounds.

(h) Each integral fuel tank must have provisions for inspection and repair of its interior.

(Change 527-1 (89-01-01))

(Change 527-3 (94-01-03))
(Change 527-4)

527.965 *Fuel Tank Tests*

(a) Each fuel tank must be able to withstand the applicable pressure tests in this section without failure or leakage. If practicable, test pressures may be applied in a manner simulating the pressure distribution in service.

(b) Each conventional metal tank, non-metallic tank with walls that are not supported by the rotorcraft structure, and integral tank must be subjected to a pressure of 3.5 p.s.i. unless the pressure developed during maximum limit acceleration or emergency deceleration with a full tank exceeds this value, in which case a hydrostatic head, or equivalent test, must be applied to duplicate the acceleration loads as far as possible. However, the pressure need not exceed 3.5 p.s.i. on surfaces not exposed to the acceleration loading.

(c) Each non-metallic tank with walls supported by the rotorcraft structure must be subjected to the following tests:

(1) A pressure test of at least 2.0 p.s.i. This test may be conducted on the tank alone in conjunction with the test specified in paragraph (c)(2) of this section.

(2) A pressure test, with the tank mounted in the rotorcraft structure, equal to the load developed by the reaction of the contents, with the tank full, during maximum limit acceleration or emergency deceleration. However, the pressure need not exceed 2.0 p.s.i. on surfaces not exposed to the acceleration loading.

(d) Each tank with large unsupported or unstiffened flat areas, or with other features whose failure or deformation could cause leakage, must be subjected to the following test or its equivalent:

(1) Each complete tank assembly and its support must be vibration tested while mounted to simulate the actual installation.

(2) The tank assembly must be vibrated for 25 hours while two-thirds full of any suitable fluid. The amplitude of vibration may not be less than one thirty-second of an inch, unless otherwise substantiated.

(3) The test frequency of vibration must be as follows:

(i) If no frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, the test frequency of vibration, in number of cycles per minute must, unless a frequency based on a more rational calculation is used, be the number obtained by averaging the maximum and minimum power-on engine speeds (r.p.m.) for reciprocating engine powered rotorcraft or 2,000 c.p.m. for turbine engine powered rotorcraft.

(ii) If only one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, that frequency of vibration must be the test frequency.

(iii) If more than one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, the most critical of

these frequencies must be the test frequency.

(4) Under paragraphs (d)(3)(ii) and (iii) of this section, the time of test must be adjusted to accomplish the same number of vibration cycles as would be accomplished in 25 hours at the frequency specified in paragraph (d)(3)(i) of this section.

(5) During the test, the tank assembly must be rocked at the rate of 16 to 20 complete cycles per minute through an angle of 15 degrees on both sides of the horizontal (30 degrees total), about the most critical axis, for 25 hours. If motion about more than one axis is likely to be critical, the tank must be rocked about each critical axis for 12 ½ hours.

527.967 *Fuel Tank Installation*

(a) Each fuel tank must be supported so that tank loads are not concentrated on unsupported tank surfaces. In addition:

(1) There must be pads, if necessary, to prevent chafing between each tank and its supports;

(2) The padding must be non-absorbent or treated to prevent the absorption of fuel;

(3) If flexible tank liners are used, they must be supported so that it is not necessary for them to withstand fluid loads; and

(4) Each interior surface of tank compartments must be smooth and free of projections that could cause wear of the liner unless:

(i) There are means for protection of the liner at those points; or

(ii) The construction of the liner itself provides such protection.

(b) Any spaces adjacent to tank surfaces must be adequately ventilated to avoid accumulation of fuel or fumes in those spaces due to minor leakage. If the tank is in a sealed compartment, ventilation may be limited to drain holes that prevent clogging and excessive pressure resulting from altitude changes. If flexible tank liners are installed, the venting arrangement for the spaces between the liner and its container must maintain the proper relationship to tank vent pressures for any expected flight condition.

(c) The location of each tank must meet the requirements of 527.1185 (a) and (c).

(d) No rotorcraft skin immediately adjacent to a major air outlet from the engine compartment may act as the wall of the integral tank.

(Change 527-3 (94-01-03))

(Change 527-4)

527.969 *Fuel Tank Expansion Space*

Each fuel tank or each group of fuel tanks with interconnected vent systems must have an expansion space of not less than 2 percent of the tank capacity. It must be impossible to fill the fuel tank expansion space inadvertently with the rotorcraft in the normal ground attitude.

527.971 *Fuel Tank Sump*

(a) Each fuel tank must have a drainable sump with an effective capacity in any ground attitude to be expected in service of 0.25 percent of the tank capacity or 1/16 gallon, whichever is greater, unless:

(1) The fuel system has a sediment bowl or chamber that is accessible for pre-flight drainage and has a minimum capacity of 1 ounce for every 20 gallons of fuel tank capacity; and

(2) Each fuel tank drain is located so that in any ground attitude to be expected in service, water will drain from all parts of the tank to the sediment bowl or chamber.

(b) Each sump, sediment bowl, and sediment chamber drain required by this section must comply with the drain provisions of 527.999 (b).

(Change 527-3 (94-01-03))

527.973 *Fuel Tank Filler Connection*

(a) Each fuel tank filler connection must prevent the entrance of fuel into any part of the rotorcraft other than the tank itself during normal operations and must be crash resistant during a survivable impact in accordance with 527.952 (c). In addition:

(1) Each filler must be marked as prescribed in 527.1557 (c)(1);

(2) Each recessed filler connection that can retain any appreciable quantity of fuel must have a drain that discharges clear of the entire rotorcraft; and

(3) Each filler cap must provide a fuel-tight seal under the fluid pressure expected in normal operation and in a survivable impact.

(b) Each filler cap or filler cap cover must warn when the cap is not fully locked or seated on the filler connection.

(Change 527-3 (94-01-03))

(Change 527-4)

527.975 *Fuel Tank Vents*

(a) Each fuel tank must be vented from the top part of the expansion space so that venting is effective under all normal flight conditions. Each vent must minimize the probability of stoppage by dirt or ice.

(b) The venting system must be designed to minimize spillage of fuel through the vents to an ignition source in the event of a rollover during landing, ground operation, or a survivable impact.

Information Note:

At Change 527-3, paragraph (b) contained a variation, which is now superseded. Refer to the information on FAR Amendment 27-30 and 27-35.

(Change 527-3 (94-01-03))

(Change 527-4)

527.977 *Fuel Tank Outlet*

(a) There must be a fuel strainer for the fuel tank outlet or for the booster pump. This strainer must:

(1) For reciprocating engine powered rotorcraft, have 8 to 16 meshes per inch; and

(2) For turbine engine powered rotorcraft, prevent the passage of any object that could restrict fuel flow or damage any fuel system component.

(b) The clear area of each fuel tank outlet strainer must be at least five times the area of the outlet line.

(c) The diameter of each strainer must be at least that of the fuel tank outlet.

(d) Each finger strainer must be accessible for inspection and cleaning.

Fuel System Components

527.991 *Fuel Pumps*

Compliance with 527.955 may not be jeopardized by failure of:

(a) Any one pump except pumps that are approved and installed as parts of a type certificated engine; or

(b) Any component required for pump operation except, for engine driven pumps, the engine served by that pump.

(Change 527-1 (89-01-01))

527.993 *Fuel System Lines and Fittings*

(a) Each fuel line must be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure and accelerated flight conditions.

(b) Each fuel line connected to components of the rotorcraft between which relative motion could exist must have provisions for flexibility.

(c) Flexible hose must be approved.

(d) Each flexible connection in fuel lines that may be under pressure or subjected to axial loading must use flexible hose assemblies.

(e) No flexible hose that might be adversely affected by high temperatures may be used where excessive temperatures will exist during operation or after engine shut-down.

527.995 *Fuel Valves*

(a) There must be a positive, quick-acting valve to shut off fuel to each engine individually.

(b) The control for this valve must be within easy reach of appropriately crew members.

(c) Where there is more than one source of fuel supply there must be means for independent feeding from each source.

(d) No shut-off valve may be on the engine side of any firewall.

527.997 *Fuel Strainer or Filter*

There must be a fuel strainer or filter between the fuel tank outlet and the inlet of the first fuel system component which is susceptible to fuel contamination, including but not limited to the fuel metering device or an engine positive displacement pump, whichever is nearer the fuel tank outlet. This fuel strainer or filter must:

(a) Be accessible for draining and cleaning and must incorporate a screen or element which is easily removable;

(b) Have a sediment trap and drain except that it need not have a drain if the strainer or filter is easily removable for drain purposes;

(c) Be mounted so that its weight is not supported by the connecting lines or by the inlet or outlet connections of the strainer or filter itself, unless adequate strength margins under all loading conditions are provided in the lines and connections; and

(d) Provide a means to remove from the fuel any contaminant which would jeopardize the flow of fuel through rotorcraft or engine fuel system components required for proper rotorcraft fuel system or engine fuel system operation.

(Change 527-1 (89-01-01))

527.999 *Fuel System Drains*

(a) There must be at least one accessible drain at the lowest point in each fuel system to completely drain the system with the rotorcraft in any ground attitude to be expected in service.

(b) Each drain required by paragraph (a) of this section must:

(1) Discharge clear of all parts of the rotorcraft;

(2) Have manual or automatic means to assure positive closure in the off position; and

(3) Have a drain valve:

(i) That is readily accessible and which can be easily opened and closed; and

(ii) That is either located or protected to prevent fuel spillage in the event of a landing with landing gear retracted.

(Change 527-1 (89-01-01))

Oil System

527.1011 *Engines:General*

(a) Each engine must have an independent oil system that can supply it with an appropriate quantity of oil at a temperature not above that safe for continuous operation.

(b) The usable oil capacity of each system may not be less than the product of the endurance of the rotorcraft under critical operating conditions and the maximum oil consumption of the engine under the same conditions, plus a suitable margin to ensure adequate circulation and cooling. Instead of a rational analysis of endurance and consumption, a usable oil capacity of 1 gallon for each 40 gallons of usable fuel may be used.

(c) The oil cooling provisions for each engine must be able to maintain the oil inlet temperature to that engine at or below the maximum established value. This must be shown by flight tests.

(Change 527-1 (89-01-01))

527.1013 *Oil Tanks*

Each oil tank must be designed and installed so that:

(a) It can withstand, without failure, each vibration, inertia, fluid, and structural load expected in operation;

(b) (Reserved)

(c) Where used with a reciprocating engine, it has an expansion space of not less than the greater of 10 percent of the tank capacity or 0.5 gallon, and where used with a turbine engine, it has an expansion space of not less than 10 percent of the tank capacity.

(d) It is impossible to fill the tank expansion space inadvertently with the rotorcraft in the normal ground attitude;

(e) Adequate venting is provided; and

(f) There are means in the filler opening to prevent oil overflow from entering the oil tank compartment.

527.1015 *Oil Tank Tests*

Each oil tank must be designed and installed so that it can withstand, without leakage, an internal pressure of 5 p.s.i., except that each pressurized oil tank used with a turbine engine must be designed and installed so that it can withstand, without leakage, an internal pressure of 5 p.s.i., plus the maximum operating pressure of the tank.

527.1017 *Oil Lines and Fittings*

(a) Each oil line must be supported to prevent excessive vibration.

(b) Each oil line connected to components of the rotorcraft between which relative motion could exist must have provisions for flexibility.

(c) Flexible hose must be approved.

(d) Each oil line must have an inside diameter of not less than the inside diameter of the engine inlet or outlet. No line may have splices between connections.

527.1019 *Oil Strainer or Filter*

(a) Each turbine engine installation must incorporate an oil strainer or filter through which all the engine oil flows and which meets the following requirements:

(1) Each oil strainer or filter that has a bypass must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter completely blocked.

(2) The oil strainer or filter must have the capacity (with respect to operating limitations established for the engine) to ensure that engine oil system functioning is not impaired when the oil is contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine under Chapter 533 of this Manual.

(3) The oil strainer or filter, unless it is installed at an oil tank outlet, must incorporate a means to indicate contamination before it reaches the capacity established in accordance with paragraph (a)(2) of this section.

(4) The bypass of a strainer or filter must be constructed and installed so that the release of collected contaminants is minimized by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path.

(5) An oil strainer or filter that has no bypass, except one that is installed at an oil tank outlet, must have a means to connect it to the warning system required in 527.1305 (r).

(b) Each oil strainer or filter in a powerplant installation using reciprocating engines must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter element completely blocked.

(Change 527-1 (89-01-01))

527.1021 *Oil System Drains*

A drain (or drains) must be provided to allow safe drainage of the oil system. Each drain must:

(a) Be accessible; and

(b) Have manual or automatic means for positive locking in the closed position.

527.1027 *Transmissions and Gearboxes:General*

(a) The lubrication system for components of the rotor drive system that require continuous lubrication must be sufficiently independent of the lubrication systems of the engine(s) to ensure lubrication during autorotation.

(b) Pressure lubrication systems for transmissions and gearboxes must comply with the engine oil system requirements of 527.1013 (except paragraph (c)), 527.1015, 527.1017, 527.1021 and 527.1337 (d).

(c) Each pressure lubrication system must have an oil strainer or filter through which all of the lubricant flows and must:

(1) Be designed to remove from the lubricant any contaminant which may damage transmission and drive system components or impede the flow of lubricant to a hazardous degree;

(2) Be equipped with a means to indicate collection of contaminants on the filter or strainer at or before opening of the bypass required by paragraph (c)(3) of this section; and

(3) Be equipped with a bypass constructed and installed so that:

(i) The lubricant will flow at the normal rate through the rest of the system with the strainer or filter completely blocked; and

(ii) The release of collected contaminants is minimized by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow-path.

(d) For each lubricant tank or sump outlet supplying lubrication to rotor drive systems and rotor drive system components, a screen must be provided to prevent entrance into the lubrication system of any object that might obstruct the flow of lubricant from the outlet to the filter required by paragraph (c) of this section. The requirements of paragraph (c) do not apply to screens installed at lubricant tank or sump outlets.

(e) Splash-type lubrication systems for rotor drive system gear boxes must comply with 527.1021 and 527.1337 (d).

(Change 527-1 (89-01-01))
(Change 527-4)

Cooling

527.1041 *General*

(a) Each powerplant cooling system must be able to maintain the temperatures of powerplant components within the limits established for these components under critical surface (ground or water) and flight operating conditions for which certification is required and after normal shut-down. Powerplant components to be considered include but may not be limited to engines, rotor drive system components, auxiliary power units, and the cooling or lubricating fluids used with these components.

(b) Compliance with paragraph (a) of this section must be shown in tests conducted under the conditions prescribed in that paragraph.

(Change 527-1 (89-01-01))

527.1043 *Cooling Tests*

(a) General. For the tests prescribed in 527.1041 (b), the following apply:

(1) If the tests are conducted under conditions deviating from the maximum ambient atmospheric temperature specified in paragraph (b) of this section, the recorded powerplant temperatures must be corrected under paragraphs (c) and (d) of this section unless a more rational correction method is applicable.

(2) No corrected temperature determined under subparagraph (1) of this paragraph may exceed established limits.

(3) For reciprocating engines, the fuel used during the cooling tests must be of the minimum grade approved for the engines, and the mixture settings must be those normally used in the flight stages for which the cooling tests are conducted.

(4) The test procedures must be as prescribed in 527.1045.

(b) Maximum ambient atmospheric temperature. A maximum ambient atmospheric temperature corresponding to sea level conditions of at least 100 degrees F must be established. The assumed temperature lapse rate is 3.6 degrees F per thousand feet of altitude above sea level until a temperature of -69.7 degrees F is reached, above which altitude the temperature is considered constant at -69.7 degrees F. However, for winterization installations, the applicant may select a maximum ambient atmospheric temperature corresponding to sea level conditions of less than 100 degrees F.

(c) Correction factor (except cylinder barrels). Unless a more rational correction applies, temperatures of engine fluids and powerplant components (except cylinder barrels) for which temperature limits are established, must be corrected by adding to them the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum component or fluid temperature recorded during the cooling test.

(d) Correction factor for cylinder barrel temperatures. Cylinder barrel temperatures must be corrected by adding to them 0.7 times the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test.

527.1045 *Cooling Test Procedures*

(a) General. For each stage of flight, the cooling tests must be conducted with the rotorcraft:

(1) In the configuration most critical for cooling; and

(2) Under the conditions most critical for cooling.

(b) Temperature stabilization. For the purpose of the cooling tests, a temperature is "stabilized" when its rate of change is less than 2°F per minute. The following component and engine fluid temperature stabilization rules apply:

(1) For each rotorcraft, and for each stage of flight:

(i) The temperatures must be stabilized under the conditions from which entry is made into the stage of flight being investigated; or

(ii) If the entry condition normally does not allow temperatures to stabilize, operation through the fuel entry condition must be conducted before entry into the stage of flight being investigated in order to allow the temperatures to attain their natural levels at the time of entry.

(2) For each helicopter during the take-off stage of flight, the climb at takeoff power must be preceded by a period of hover during which the temperatures are stabilized.

(c) Duration of test. For each stage of flight the tests must be continued until:

(1) The temperatures stabilize or 5 minutes after the occurrence of the highest temperature recorded, as appropriate to the test condition;

(2) That stage of flight is completed; or

(3) An operating limitation is reached.

(Change 527-1 (89-01-01))

Induction System

527.1091 *Air Induction*

(a) The air induction system for each engine must supply the air required by that engine under the operating conditions and manoeuvres for which certification is requested.

(b) Each cold air induction system opening must be outside the cowling if backfire flames can emerge.

(c) If fuel can accumulate in any air induction system, that system must have drains that discharge fuel:

(1) Clear of the rotorcraft; and

(2) Out of the path of exhaust flames.

(d) For turbine engine powered rotorcraft:

(1) There must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents or other components of flammable fluid systems from entering the engine intake system; and

(2) The air inlet ducts must be located or protected so as to minimize the ingestion of foreign matter during takeoff , landing, and taxiing.

(Change 527-1 (89-01-01))

527.1093 *Induction System Icing Protection*

(a) Reciprocating engines. Each reciprocating engine air induction system must have means to prevent and eliminate icing. Unless this is done by other means, it must be shown that, in air free of visible moisture at a temperature of 30°F, and with the engines at 75 percent of maximum continuous power:

(1) Each rotorcraft with sea level engines using conventional venturi carburetors has a preheater that can provide a heat rise of 90°F;

(2) Each rotorcraft with sea level engines using carburetors tending to prevent icing has a sheltered alternate source of air, and that the preheat supplied to the alternate air intake is not less than that provided by the engine cooling air downstream of the cylinders;

(3) Each rotorcraft with altitude engines using conventional venturi carburetors has a preheater capable of providing a heat rise of 120°F; and

(4) Each rotorcraft with altitude engines using carburetors tending to prevent icing has a preheater that can provide a heat rise of:

(i) 100°F; or

(ii) If a fluid de-icing system is used, at least 40°F.

(b) Turbine engines.

(1) It must be shown that each turbine engine and its air inlet system can operate throughout the flight power range of the engine (including idling):

(i) Without accumulating ice on engine or inlet system components that would adversely affect engine operation or cause a serious loss of power under the icing conditions specified in Appendix C of Chapter 529 of this Manual; and

(ii) <u>In falling, blowing, and recirculating snow without adverse effect on engine operation; or</u>

FAR: (ii) In snow, both falling and blowing, without adverse effect on engine operation, within the limitations established for the rotorcraft.

(iii) <u>If certification for flight in snow has not been requested, the engine tolerance to snow shall be demonstrated.</u>

FAR: No equivalent text.

(2) Each turbine engine must idle for 30 minutes on the ground, with the air bleed available for engine icing protection at its critical condition, without adverse effect, in an atmosphere that is at a temperature between 15° and 30°F (between -9° and -1°C) and has a liquid water content not less than 0.3 grams per cubic meter in the form of drops having a mean effective diameter of not less than 20 microns, followed by momentary operation at takeoff power or thrust. During the 30 minutes of idle operation, the engine may run up periodically to a moderate power or thrust setting in a manner acceptable to the Minister.

(c) Supercharged reciprocating engines. For each engine having superchargers to pressurize the air before it enters the carburetor, the heat rise in the air caused by that supercharging at any altitude may be utilized in determining compliance with paragraph (a) of this section if the heat rise utilized is that which will be available, automatically, for the applicable altitude and operating condition because of supercharging.

(Change 527-1 (89-01-01))

(Change 527-2 (92-02-01))

(Change 527-4)

Exhaust System

527.1121 *General*

For each exhaust system:

(a) There must be means for thermal expansion of manifolds and pipes;

(b) There must be means to prevent local hot spots;

(c) Exhaust gases must discharge clear of the engine air intake, fuel system components, and drains;

(d) Each exhaust system part with a surface hot enough to ignite flammable fluids or vapours must be located or shielded so that leakage from any system carrying flammable fluids or vapours will not result in a fire caused by impingement of the fluids or vapours on any part of the exhaust system including shields for the exhaust system;

(e) Exhaust gases may not impair pilot vision at night due to glare;

(f) If significant traps exist, each turbine engine exhaust system must have drains discharging clear of the rotorcraft, in any normal ground and flight attitudes, to prevent fuel accumulation after the failure of an attempted engine start;

(g) Each exhaust heat exchanger must incorporate means to prevent blockage of the exhaust port after any internal heat exchanger failure.

527.1123 *Exhaust Piping*

(a) Exhaust piping must be heat and corrosion resistant, and must have provisions to prevent failure due to expansion by operating temperatures.

(b) Exhaust piping must be supported to withstand any vibration and inertia loads to which it would be subjected in operations.

(c) Exhaust piping connected to components between which relative motion could exist must have provisions for flexibility.

Powerplant Controls and Accessories

527.1141 *Powerplant Controls:General*

(a) Powerplant controls must be located and arranged under 527.777 and marked under 527.1555.

(b) Each flexible powerplant control must be approved.

(c) Each control must be able to maintain any set position without:

(1) Constant attention; or

(2) Tendency to creep due to control loads or vibration.

(d) Controls of powerplant valves required for safety must have:

(1) For manual valves, positive stops or in the case of fuel valves suitable index provisions, in the open and closed position; and

(2) For power-assisted valves, a means to indicate to the flight crew when the valve:

(i) Is in the fully open or fully closed position; or

(ii) Is moving between the fully open and fully closed position.

(e) For turbine engine powered rotorcraft, no single failure or malfunction, or probable combination thereof, in any powerplant control system may cause the failure of any powerplant function necessary for safety.

(Change 527-1 (89-01-01))
(Change 527-4)

527.1143 *Engine Controls*

(a) There must be a separate power control for each engine.

(b) Power controls must be grouped and arranged to allow:

(1) Separate control of each engine; and

(2) Simultaneous control of all engines.

(c) Each power control must provide a positive and immediately responsive means of controlling its engine.

(d) If a power control incorporates a fuel shut-off feature, the control must have a means to prevent the inadvertent movement of the control into the shut-off position. The means must:

(1) Have a positive lock or stop at the idle position; and

(2) Require a separate and distinct operation to place the control in the shut-off position.

(e) For rotorcraft to be certificated for a 30-second OEI power rating, a means must be provided to automatically activate and control the 30-second OEI power and prevent any engine from exceeding the installed engine limits associated with the 30-second OEI power rating approved for the rotorcraft.

(Change 527-1 (89-01-01))

(Change 527-4)

527.1145 *Ignition Switches*

(a) There must be means to quickly shut off all ignition by the grouping of switches or by a master ignition control.

(b) Each group of ignition switches, except ignition switches for turbine engines for which continuous ignition is not required, and each master ignition control must have a means to prevent its inadvertent operation.

527.1147 *Mixture Controls*

If there are mixture controls, each engine must have a separate control and the controls must be arranged to allow:

(a) Separate control of each engine; and

(b) Simultaneous control of all engines.

527.1151 *Rotor Brake Controls*

(a) It must be impossible to apply the rotor brake inadvertently in flight.

(b) There must be means to warn the crew if the rotor brake has not been completely released before takeoff .

(Change 527-4)

527.1163 *Powerplant Accessories*

(a) Each engine-mounted accessory must:

(1) Be approved for mounting on the engine involved;

(2) Use the provisions on the engine for mounting; and

(3) Be sealed in such a way as to prevent contamination of the engine oil system and the accessory system.

(b) Unless other means are provided, torque limiting means must be provided for accessory drives located on any component of the transmission and rotor drive system to prevent damage to these components from excessive accessory load.

(Change 527-1 (89-01-01))

Powerplant Fire Protection

527.1183 *Lines, Fittings, and Components*

(a) Except as provided in paragraph (b) of this section, each line, fitting, and other component carrying flammable fluid in any area subject to engine fire conditions must be fire resistant, except that flammable fluid tanks and supports which are part of and attached to the engine must be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. Components must be shielded or located so as to safeguard against the ignition of leaking flammable fluid. An integral oil sump of less than 25 quart capacity on a reciprocating engine need not be fireproof nor be enclosed by a fireproof shield.

(b) Paragraph (a) does not apply to:

(1) Lines, fittings, and components which are already approved as part of a type certificated engine; and

(2) Vent and drain lines, and their fittings, whose failure will not result in, or add to, a fire hazard.

(c) Each flammable fluid drain and vent must discharge clear of the induction system air inlet.

527.1185 *Flammable Fluids*

(a) Each fuel tank must be isolated from the engines by a firewall or shroud.

(b) Each tank or reservoir, other than a fuel tank, that is part of a system containing flammable fluids or gases must be isolated from the engine by a firewall or shroud, unless the design of the system, the materials used in the tank and its supports, the shut-off means, and the connections, lines and controls provide a degree of safety equal to that which would exist if the tank or reservoir were isolated from the engines.

(c) There must be at least one-half inch of clear airspace between each tank and each firewall or shroud isolating that tank, unless equivalent means are used to prevent heat transfer from each engine compartment to the flammable fluid.

(d) Absorbent materials close to flammable fluid system components that might leak must be covered or treated to prevent the absorption of hazardous quantities of fluids.

(Change 527-4)

527.1187 *Ventilation and Drainage*

Each compartment containing any part of the powerplant installation must have provision for ventilation and drainage of flammable fluids. The drainage means must be:

(a) Effective under conditions expected to prevail when drainage is needed, and

(b) Arranged so that no discharged fluid will cause an additional fire hazard.

(Change 527-4)

527.1189 *Shut-off Means*

(a) There must be means to shut off each line carrying flammable fluids into the engine compartment, except:

(1) Lines, fittings, and components forming an integral part of an engine;

(2) For oil systems for which all components of the system, including oil tanks, are fireproof or located in areas not subject to engine fire conditions; and

(3) For reciprocating engine installations only, engine oil system lines in installations using engines of less than 500 cu. in. displacement.

(b) There must be means to guard against inadvertent operation of each shut-off, and to make it possible for the crew to reopen it in flight after it has been closed.

(c) Each shut-off valve and its control must be designed, located, and protected to function properly under any condition likely to result from an engine fire.

(Change 527-1 (89-01-01))

527.1191 *Firewalls*

(a) Each engine, including the combustor, turbine, and tailpipe sections of turbine engines must be isolated by a firewall, shroud, or equivalent means, from personnel compartments, structures, controls, rotor mechanisms, and other parts that are:

(1) Essential to a controlled landing; and

(2) Not protected under 527.861.

(b) Each auxiliary power unit and combustion heater, and any other combustion equipment to be used in flight, must be isolated from the rest of the rotorcraft by firewalls, shrouds, or equivalent means.

(c) In meeting paragraphs (a) and (b) of this section, account must be taken of the probable path of a fire as affected by the airflow in normal flight and in autorotation.

(d) Each firewall and shroud must be constructed so that no hazardous quantity of air, fluids, or flame can pass from any engine compartment to other parts of the rotorcraft.

(e) Each opening in the firewall or shroud must be sealed with close-fitting, fireproof grommets, bushings, or firewall fittings.

(f) Each firewall and shroud must be fireproof and protected against corrosion.

527.1193 *Cowling and Engine Compartment Covering*

(a) Each cowling and engine compartment covering must be constructed and supported so that it can resist the vibration, inertia, and air loads to which it may be subjected in operation.

(b) There must be means for rapid and complete drainage of each part of the cowling or engine compartment in the normal ground and flight attitudes.

(c) No drain may discharge where it might cause a fire hazard.

(d) Each cowling and engine compartment covering must be at least fire resistant.

(e) Each part of the cowling or engine compartment covering subject to high temperatures due to its nearness to exhaust system parts or exhaust gas impingement must be fireproof.

(f) A means of retaining each openable or readily removable panel, cowling, or engine or rotor drive system covering must be provided to preclude hazardous damage to rotors or critical control components in the event of structural or mechanical failure of the normal retention means, unless such failure is extremely improbable.

(Change 527-1 (89-01-01))

527.1194 *Other Surfaces*

All surfaces aft of, and near, powerplant compartments, other than tail surfaces not subject to heat, flames or sparks emanating from a powerplant compartment, must be at least fire resistant.

527.1195 *Fire Detector Systems*

Each turbine engine power rotorcraft must have approved quick-acting fire detectors in numbers and locations insuring prompt detection of fire in the engine compartment which cannot be readily observed in flight by the pilot in the cockpit.

SUBCHAPTER F
EQUIPMENT - GENERAL

527.1301 *Function and Installation*

Each item of installed equipment must:

(a) Be of a kind and design appropriate to its intended function;

(b) Be labelled as to its identification, function, or operating limitations, or any applicable combination of these factors;

(c) Be installed according to limitations specified for that equipment; and

(d) Function properly when installed.

527.1301-1 *Rotorcraft Operations After Ground Cold Soak*

Substantiation of satisfactory operation of the rotorcraft as a total system, by cold weather testing or by documented evidence of satisfactory operation at low temperature is required after the rotorcraft has experienced a prolonged exposure to ground ambient temperatures equal to or less than -35°C unless an alternative minimum ground ambient temperature has been proposed by the applicant and accepted by the Minister.

FAR: No equivalent text.

(amended 2004/12/01)

527.1303 Flight and Navigation Instruments

The following are the required flight and navigation instruments:

(a) An airspeed indicator.

(b) An altimeter.

(c) A magnetic direction indicator.

527.1305 *Powerplant Instruments*

The following are the required powerplant instruments:

(a) A carburetor air temperature indicator, for each engine having a preheater that can provide a heat rise in excess of 60°F.

(b) A cylinder head temperature indicator, for each:

(1) Air cooled engine;

(2) Rotorcraft with cooling shutters; and

(3) Rotorcraft for which compliance with 527.1043 is shown in any condition other than the most critical flight condition with respect to cooling.

(c) A fuel pressure indicator, for each pump-fed engine.

(d) A fuel quantity indicator, for each fuel tank.

(e) A manifold pressure indicator, for each altitude engine.

(f) An oil temperature warning device to indicate when the temperature exceeds a safe value in each main rotor drive gearbox (including any gearboxes essential to rotor phasing) having an oil system independent of the engine oil system.

(g) An oil pressure warning device to indicate when the pressure falls below a safe value in each pressure-lubricated main rotor drive gearbox (including any gearboxes essential to rotor phasing) having an oil system independent of the engine oil system.

(h) An oil pressure indicator for each engine.

(i) An oil quantity indicator for each oil tank.

(j) An oil temperature indicator for each engine.

(k) At least one tachometer to indicate the r.p.m. of each engine and, as applicable:

(1) The r.p.m. of the single main rotor;

(2) The common r.p.m. of any main rotors whose speeds cannot vary appreciably with respect to each other; or

(3) The r.p.m. of each main rotor whose speed can vary appreciably with respect to that of another main rotor.

(l) A low fuel warning device for each fuel tank which feeds an engine. This device must:

(1) Provide a warning to the flight crew when approximately 10 minutes of usable fuel remains in the tank; and

(2) Be independent of the normal fuel quantity indicating system.

(m) Means to indicate to the flight crew the failure of any fuel pump installed to show compliance with 527.955.

(n) A gas temperature indicator for each turbine engine.

(o) Means to enable the pilot to determine the torque of each turbo shaft engine, if a torque limitation is established for that engine under 527.1521 (e).

(p) For each turbine engine, an indicator to indicate the functioning of the powerplant ice protection system.

(q) An indicator for the fuel filter required by 527.997 to indicate the occurrence of contamination of the filter at the degree established by the applicant in compliance with 527.955.

(r) For each turbine engine, a warning means for the oil strainer or filter required by 527.1019, if it has no bypass, to warn the pilot of the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with 527.1019 (a)(2).

(s) An indicator to indicate the functioning of any selectable or controllable heater used to prevent ice clogging of fuel system components.

(t) For rotorcraft for which a 30-second/2 minute OEI power rating is requested, a means must be provided to alert the pilot when the engine is at the 30-second and the 2-minute OEI power levels, when the event begins, and when the time interval expires.

(u) For each turbine engine utilizing 30-second/2 minute OEI power, a device or system must be provided for use by ground personnel which:

(1) Automatically records each usage and duration of power at the 30-second and 2-minute OEI levels;

(2) Permits retrieval of the recorded data;

(3) Can be reset only by ground maintenance personnel; and

(4) Has a means to verify proper operation of the system or device.

(v) Warning or caution devices to signal to the flight crew when ferromagnetic particles are detected by the chip detector required by 527.1337 (e).

(Change 527-1 (89-01-01))

(Change 527-4)

527.1307 *Miscellaneous Equipment*

The following is the required miscellaneous equipment:

(a) An approved seat for each occupant.

(b) An approved safety belt for each occupant.

(c) A master switch arrangement.

(d) An adequate source of electrical energy, where electrical energy is necessary for operation of the rotorcraft.

(e) Electrical protective devices.

527.1309 *Equipment, Systems, and Installations*

(a) The equipment, systems, and installations whose functioning is required by this Manual must be designed and installed to ensure that they perform their intended functions under any foreseeable operating condition.

(b) The equipment, systems, and installations of a multi-engine rotorcraft must be designed to prevent hazards to the rotorcraft in the event of a probable malfunction or failure.

(c) The equipment, systems, and installations of single-engine rotorcraft must be designed to minimize hazards to the rotorcraft in the event of a probable malfunction or failure.

(d) In showing compliance with paragraph (a), (b), or (c) of this section, the effects of lightning strikes on the rotorcraft must be considered in accordance with 527.610.

527.1317 *High-intensity Radiated Fields (HIRF) Protection*
(amended 2008/10/30)

(a) Except as provided in paragraph (d) of this section, each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the rotorcraft shall be designed and installed so that:
(amended 2008/10/30)

(1) The function is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment I, as described in Appendix D of this chapter;
(amended 2008/10/30)

(2) The system automatically recovers normal operation of that function, in a timely manner, after the rotorcraft is exposed to HIRF environment I, as described in Appendix D of this chapter, unless this conflicts with other operational or functional requirements of that system;
(amended 2008/10/30)

(3) The system is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment II, as described in Appendix D of this chapter; and
(amended 2008/10/30)

(4) Each function required during operation under visual flight rules is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment III, as described in Appendix D of this chapter.
(amended 2008/10/30)

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the rotorcraft or the ability of the flight crew to respond to an adverse operating condition shall be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 1 or 2, as described in Appendix D of this chapter.
(amended 2008/10/30)

(c) Each electrical and electronic system that performs a function whose failure would reduce the capability of the rotorcraft or the ability of the flight crew to respond to an adverse operating condition, shall be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 3, as described in Appendix D of this chapter.
(amended 2008/10/30)

(d) Before December 1, 2012, an electrical or electronic system that performs a function whose failure would prevent the continued safe flight and landing of a rotorcraft may be designed and installed without meeting the provisions of paragraph (a) provided:
(amended 2008/10/30)

(1) The system has previously been shown to comply with Special Conditions - Airworthiness for HIRF, specified by the Minister pursuant to Part V of the *Canadian Aviation Regulations* (CARs).
(amended 2008/10/30)

(2) The HIRF immunity characteristics of the system have not changed since compliance with the special conditions was demonstrated; and
(amended 2008/10/30)

(3) The data used to demonstrate compliance with the Special Conditions - Airworthiness for HIRF is provided.
(amended 2008/10/30)

Instruments:Installation

527.1321 *Arrangement and Visibility*

(a) Each flight, navigation, and powerplant instrument for use by any pilot must be easily visible to him.

(b) For each multi-engine rotorcraft, identical powerplant instruments must be located so as to prevent confusion as to which engine each instrument relates.

(c) Instrument panel vibration may not damage, or impair the readability or accuracy of, any instrument.

(d) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

527.1322 *Warning, Caution, and Advisory Lights*

If warning, caution or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Minister, be:

(a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights; and

(d) Any other colour, including white, for lights not described in paragraphs (a) through (c) of this section, provided the colour differs sufficiently from the colours prescribed in paragraphs (a) through (c) of this section to avoid possible confusion.

527.1323 *Airspeed Indicating System*

(a) Each airspeed indicating instrument must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration error when the corresponding pitot and static pressures are applied.

(b) The airspeed indicating system must be calibrated in flight at forward speeds of 20 knots and over.

(c) At each forward speed above 80 percent of the climb out speed, the airspeed indicator must indicate true airspeed, at sea level with a standard atmosphere, to within an allowable installation error of not more than the greater of:

(1) +3 percent of the calibrated airspeed; or

(2) 5 knots.

527.1325 *Static Pressure Systems*

(a) Each instrument with static air case connections must be vented so that the influence of rotorcraft speed, the opening and closing of windows, airflow variation, and moisture or other foreign matter does not seriously affect its accuracy.

(b) Each static pressure port must be designed and located in such manner that the correlation between air pressure in the static pressure system and true ambient atmospheric static pressure is not altered when the rotorcraft encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in showing compliance with this requirement. If the reading of the altimeter, when on the alternate static pressure system, differs from the reading of the altimeter when on the primary static system by more the 50 feet, a correction card must be provided for the alternate static system.

(c) Except as provided in paragraph (d) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that:

(1) When either source is selected, the other is blocked off; and

(2) Both sources cannot be blocked off simultaneously.

(d) For unpressurized rotorcraft, paragraph (c)(1) of the section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

527.1327 *Magnetic Direction Indicator*

(a) Except as provided in paragraph (b) of this section:

(1) Each magnetic direction indicator must be installed so that its accuracy is not excessively affected by the rotorcraft's vibration or magnetic fields; and

(2) The compensated installation may not have a deviation, in level flight, greater than 10 degrees on any heading.

(b) A magnetic non-stabilized direction indicator may deviate more than 10 degrees due to the operation of electrically powered systems such as electrically heated windshields if either a magnetic stabilized direction indicator, which does not have a deviation in level flight greater than 10 degrees on any heading, or a gyroscopic direction indicator, is

installed. Deviations of a magnetic non-stabilized direction indicator of more than 10 degrees must be placarded in accordance with 527.1547 (e).

527.1329 *Automatic Pilot System*

(a) Each automatic pilot system must be designed so that the automatic pilot can:

(1) Be sufficiently overpowered by one pilot to allow control of the rotorcraft; and

(2) Be readily and positively disengaged by each pilot to prevent it from interfering with control of the rotorcraft.

(b) Unless there is automatic synchronization, each system must have a means to readily indicate to the pilot the alignment of the actuating device in relation to the control system it operates.

(c) Each manually operated control for the system's operation must be readily accessible to the pilots.

(d) The system must be designed and adjusted so that, within the range of adjustment available to the pilot, it cannot produce hazardous loads on the rotorcraft or create hazardous deviations in the flight path under any flight condition appropriate to its use, either during normal operation or in the event of a malfunction, assuming that corrective action begins within a reasonable period of time.

(e) If the automatic pilot integrates signals from auxiliary controls or furnishes signals for operation of other equipment, there must be positive interlocks and sequencing of engagement to prevent improper operation.

(f) If the automatic pilot system can be coupled to airborne navigation equipment, means must be provided to indicate to the pilots the current mode of operation. Selector switch position is not acceptable as a means of indication.

(Change 527-4)

527.1335 *Flight Director Systems*

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

527.1337 *Powerplant Instruments*

(a) Instruments and instrument lines.

(1) Each powerplant instrument line must meet the requirements of 527.961 and 527.993.

(2) Each line carrying flammable fluids under pressure must:

(i) Have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails; and

(ii) Be installed and located so that the escape of fluids would not create a hazard.

(3) Each powerplant instrument that utilizes flammable fluids must be installed and located so that the escape of fluid would not create a hazard.

(b) Fuel quantity indicator. Each fuel quantity indicator must be installed to clearly indicate to the flight crew the quantity of fuel in each tank in flight. In addition:

(1) Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under 527.959;

(2) When two or more tanks are closely interconnected by a gravity feed system and vented, and when it is impossible to feed from each tank separately, at least one fuel quantity indicator must be installed; and

(3) Each exposed sight gauge used as a fuel quantity indicator must be protected against damage.

(c) Fuel flow meter system. If a fuel flow meter system is installed, each metering component must have a means for bypassing the fuel supply if malfunction of that component severely restricts fuel flow.

(d) Oil quantity indicator. There must be means to indicate the quantity of oil in each tank:

(1) On the ground (including during the filling of each tank); and

(2) In flight, if there is an oil transfer system or reserve oil supply system.

(e) Rotor drive system transmissions and gearboxes utilizing ferromagnetic materials must be equipped with chip detectors designed to indicate or reveal the presence of ferromagnetic particles resulting from damage or excessive wear. Chip detectors must:

(1) Be designed to provide a signal to the device required by 527.1305 (v) and be provided with a means to allow crew members to check, in flight, the function of each detector electrical circuit and signal.

(2) Reserved

(Change 527-1 (89-01-01))

(Change 527-4)

Electrical Systems and Equipment

527.1351 *General*

(a) Electrical system capacity. Electrical equipment must be adequate for its intended use. In addition:

(1) Electric power sources, their transmission cables, and their associated control and protective devices must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation; and

(2) Compliance with subparagraph (1) of this paragraph must be shown by an electrical load analysis, or by electrical measurements that take into account the electrical loads applied to the electrical system, in probable combinations and for probable durations.

(b) Function. For each electrical system, the following apply:

(1) Each system, when installed, must be:

(i) Free from hazards in itself, in its method of operation, and in its effects on other parts of the rotorcraft; and

(ii) Protected from fuel, oil, water, other detrimental substances, and mechanical damage.

(2) Electric power sources must function properly when connected in combination or independently.

(3) No failure or malfunction of any source may impair the ability of any remaining source to supply load circuits essential for safe operation.

(4) Each electric power source control must allow the independent operation of each source.

(c) Generating system. There must be at least one generator if the system supplies power to load circuits essential for safe operation. In addition:

(1) Each generator must be able to deliver its continuous rated power;

(2) Generator voltage control equipment must be able to dependably regulate each generator output within rated limits;

(3) Each generator must have a reverse current cutout designed to disconnect the generator from the battery and from the other generators when enough reverse current exists to damage that generator; and

(4) Each generator must have an over-voltage control designed and installed to prevent damage to the electrical system, or to equipment supplied by the electrical system, that could result if that generator were to develop an over-voltage condition.

(d) Instruments. There must be means to indicate to appropriate crewmembers the electric power system quantities essential for safe operation of the system. In addition:

(1) For direct current systems, an ammeter that can be switched into each generator feeder may be used; and

(2) If there is only one generator, the ammeter may be in the battery feeder.

(e) External power. If provisions are made for connecting external power to the rotorcraft, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the rotorcraft's electrical system.

(Change 527-1 (89-01-01))

527.1353 *Storage Battery Design and Installation*

(a) Each storage battery must be designed and installed as prescribed in this section.

(b) Safe cell temperatures and pressures must be maintained during any probable charging and discharging condition. No uncontrolled increase in cell temperature may result when the battery is recharged (after previous complete discharge):

(1) At maximum regulated voltage or power;

(2) During a flight of maximum duration; and

(3) Under the most adverse cooling condition likely to occur in service.

(c) Compliance with paragraph (b) of this section must be shown by test unless experience with similar batteries and installations has shown that maintaining safe cell temperatures and pressures presents no problem.

(d) No explosive or toxic gases emitted by any battery in normal operation, or as the result of any probable malfunction in the charging system or battery installation, may accumulate in hazardous quantities within the rotorcraft.

(e) No corrosive fluids or gases that may escape from the battery may damage surrounding structures or adjacent essential equipment.

(f) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

(g) Nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have:

(1) A system to control the charging rate of the battery automatically so as to prevent battery overheating;

(2) A battery temperature sensing and over-temperature warning system with a means for disconnecting the battery from its charging source in the event of an over-temperature condition; or

(3) A battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.

527.1357 *Circuit Protective Devices*

(a) Protective devices, such as fuses or circuit breakers, must be installed in each electrical circuit other than:

(1) The main circuits of starter motors; and

(2) Circuits in which no hazard is presented by their omission.

(b) A protective device for a circuit essential to flight safety may not be used to protect any other circuit.

(c) Each resettable circuit protective device ("trip free" device in which the tripping mechanism cannot be overridden by the operating control) must be designed so that:

(1) A manual operation is required to restore service after trippling; and

(2) If an overload or circuit fault exists, the device will open the circuit regardless of the position of the operating control.

(d) If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse must be located and identified so that it can be readily reset or replaced in flight.

(e) If fuses are used, there must be one spare of each rating, or 50 percent spare fuses of each rating, whichever is greater.

527.1361 *Master Switch*

(a) There must be a master switch arrangement to allow ready disconnection of each electric power source from the main bus. The point of disconnection must be adjacent to the sources controlled by the switch.

(b) Load circuits may be connected so that they remain energized after the switch is opened, if they are protected by circuit protective devices, rated at 5 amperes or less, adjacent to the electric power source.

(c) The master switch or its controls must be installed so that the switch is easily discernible and accessible to a crewmember in flight.

527.1365 *Electric Cables*

(a) Each electric connecting cable must be of adequate capacity.

(b) Each cable that would overheat in the event of circuit overload or fault must be at least flame resistant and may not emit dangerous quantities of toxic fumes.

(c) Insulation on electrical wire and cable installed in the rotorcraft must be self-extinguishing when tested in accordance with Appendix F, Part I (a)(3), of Chapter 525 of this Manual.

(Change 527-4)

527.1367 *Switches*

Each switch must be:

(a) Able to carry its rated current;

(b) Accessible to the crew; and

(c) Labelled as to operation and the circuit controlled.

Lights

527.1381 *Instrument Lights*

The instrument lights must:

(a) Make each instrument, switch, and other devices for which they are provided easily readable; and

(b) Be installed so that:

(1) Their direct rays are shielded from the pilot's eyes; and

(2) No objectionable reflections are visible to the pilot.

527.1383 *Landing Lights*

(a) Each required landing or hovering light must be approved.

(b) Each landing light must be installed so that:

(1) No objectionable glare is visible to the pilot;

(2) The pilot is not adversely affected by halation; and

(3) It provides enough light for night operation, including hovering and landing.

(c) At least one separate switch must be provided, as applicable:

(1) For each separately installed landing light; and

(2) For each group of landing lights installed at a common location.

527.1385 *Position Light System Installation*

(a) General. Each part of each position light system must meet the applicable requirements of this section, and each system as a whole must meet the requirements of 527.1387 through 527.1397.

(b) Forward position lights. Forward position lights must consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the rotorcraft so that, with the rotorcraft in the normal flying position, the red light is on the left side and the green light is on the right side. Each light must be approved.

(c) Rear position light. The rear position light must be a white light mounted as far aft as practicable, and must be approved.

(d) Circuit. The two forward position lights and the rear position light must make a single circuit.

(e) Light covers and colour filters. Each light cover or colour filter must be at least flame resistant and may not change colour or shape or lose any appreciable light transmission during normal use.

527.1387 *Position Light System Dihedral Angles*

(a) Except as provided in paragraph (e) of this section, each forward and rear position light must, as installed, show unbroken light within the dihedral angles described in this section.

(b) Dihedral angle *L* (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the rotorcraft, and the other at 110° to the left of the first, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle *R* (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the rotorcraft, and the other at 110° to the right of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle *A* (aft) is formed by two intersecting vertical planes making angles of 70° to the right and to the left, respectively, to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(e) If the rear position light, when mounted as far aft as practicable in accordance with 527.1385 (c), cannot show unbroken light within dihedral angle *A* (as defined in paragraph (d) of this section), a solid angle or angles of obstructed visibility totalling not more than 0.04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30° with a vertical line passing through the rear position light.

527.1389 *Position Light Distribution and Intensities*

(a) General. The intensities prescribed in this section must be provided by new equipment with light covers and colour filters in place. Intensities must be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the rotorcraft. The light distribution and intensity of each position light must meet the requirements of paragraph (b) of this section.

(b) Forward and rear position lights. The light distribution and intensities of forward and rear position lights must be expressed in terms of minimum intensities in the horizontal plane, minimum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles L, R, and A, and must meet the following requirements:

(1) *Intensities in the horizontal plane.* Each intensity in the horizontal plane (the plane containing the longitudinal axis of the rotorcraft and perpendicular to the plane of symmetry of the rotorcraft) must equal or exceed the values in 527.1391.

(2) *Intensities in any vertical plane.* Each intensity in any vertical plane (the plane perpendicular to the horizontal plane) must equal or exceed the appropriate value in 527.1393, where I is the minimum intensity prescribed in 527.1391 for the corresponding angles in the horizontal plane.

(3) *Intensities in overlaps between adjacent signals.* No intensity in any overlap between adjacent signals may exceed the values in 527.1395, except that higher intensities in overlaps may be used with main beam intensities substantially greater than the minima specified in 527.1391 and 527.1393, if the overlap intensities in relation to the main beam intensities do not adversely affect signal clarity. When the peak intensity of the

forward position lights is greater than 100 candles, the maximum overlap intensities between them may exceed the values in 527.1395 if the overlap intensity in Area A is not more than 10 percent of peak position light intensity and the overlap intensity in Area B is not more than 2.5 percent of peak position light intensity.

527.1391 *Minimum Intensities in the Horizontal Plane of Forward and Rear Position Lights*

Each position light intensity must equal or exceed the applicable values in the following table:

Dihedral angle (light included)	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity (candles)
L and *R* (forward red and green)	0° to 10°	40
	10° to 20°	30
	20° to 110°	5
A (rear white)	110° to 180°	20

527.1393 *Minimum Intensities in Any Vertical Plane of Forward and Rear Position Lights*

Each position light intensity must equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane	Intensity, *I*
0°	1.00
0° to 5°	0.90
5° to 10°	0.80
10° to 15°	0.70
15° to 20°	0.50
20° to 30°	0.30
30° to 40°	0.10
40° to 90°	0.05

527.1395 *Maximum Intensities in Overlapping Beams of Forward and Rear Position Lights*

No position light intensity may exceed the applicable values in the following table, except as provided in 527.1389 (b)(3).

Overlaps	Maximum Intensity	
	Area A (candles)	Area B (candles)
Green in dihedral angle *L*	10	4
Red in dihedral angle *R*	10	1
Green in dihedral angle *A*	5	1
Red in dihedral angle *A*	5	1
Rear white in dihedral angle *L*	5	1
Rear white in dihedral angle *R*	5	1

Where:

(a) Area A includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 10° but less than 20°; and

(b) Area B includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 20°.

527.1397 *Colour Specifications*

Each position light colour must have the applicable International Commission on Illumination chromaticity co-ordinates as follows:

(a) Aviation red:

"y" is not greater than 0.335; and

"z" is not greater than 0.002.

(b) Aviation green:

"x" is not greater than $0.440-0.320y$;

"x" is not greater than $y-0.170$; and

"y" is not less than $0.390-0.170x$.

(c) Aviation white:

"x" is not less than 0.300 and not greater than 0.540;

"y" is not less than "x--0.040" or "$y_0-0.010$", whichever is the smaller; and

"y" is not greater than "$x+0.020$" nor "$0.636-0.400x$";

Where " y_0" is the "y" co-ordinate of the Planckian radiator for the value of "x" considered.

527.1399 *Riding Light*

(a) Each riding light required for water operation must be installed so that it can:

(1) Show a white light for at least two nautical miles at night under clear atmospheric conditions; and

(2) Show a maximum practicable unbroken light with the rotorcraft on the water.

(b) Externally hung lights may be used.

527.1401 *Anti-collision Light System*

(a) General. If certification for night operation is requested, the rotorcraft must have an anti-collision light system that:

(1) Consists of one or more approved anti-collision lights located so that their emitted light will not impair the crew's vision or detract from the conspicuity of the position lights; and

(2) Meets the requirements of paragraphs (b) through (f) of this section.

(b) Field of coverage. The system must consist of enough lights to illuminate the vital areas around the rotorcraft, considering the physical configuration and flight characteristics of the rotorcraft. The field of coverage must extend in each direction within at least 30° above and 30° below the horizontal plane of the rotorcraft, except that there may be solid angles of obstructed visibility totalling not more than 0.5 steradians.

(c) Flashing characteristics. The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100, cycles per minute. The effective flash frequency is the frequency at which the rotorcraft's complete anti-collision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180, cycles per minute.

(d) Colour. Each anti-collision light must be aviation red and must meet the applicable requirements of 527.1397.

(e) Light intensity. The minimum light intensities in any vertical plane, measured with the red filter (if used) and expressed in terms of "effective" intensities, must meet the requirements of paragraph (f) of this section. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)\,dt}{0.2 + (t_2 - t_1)}$$

where:

I_e= effective intensity (candles).

$I(t)$= instantaneous intensity as a function of time.

$t_2 - t_1$ = flash time interval (seconds).

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

(f) Minimum effective intensities for anti-collision light. Each anti-collision light effective intensity must equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane	Effective intensity (candles)
0° to 5°	150
5° to 10°	90
10° to 20°	30
20° to 30°	15

Safety Equipment

527.1411 *General*

(a) Required safety equipment to be used by the crew in an emergency, such as flares and automatic life raft releases, must be readily accessible.

(b) Stowage provisions for required safety equipment must be furnished and must:

(1) Be arranged so that the equipment is directly accessible and its location is obvious; and

(2) Protect the safety equipment from damage caused by being subjected to the inertia loads specified in 527.561.

527.1413 *Safety Belts*

Each safety belt must be equipped with a metal to metal latching device.

527.1415 *Ditching Equipment*

(a) Emergency flotation and signalling equipment required by any applicable operating rule must meet the requirements of this section.

(b) Each raft and each life preserver must be approved and must be installed so that it is readily available to the crew and passengers. The storage provisions for life preservers must accommodate one life preserver for each occupant for which certification for ditching is requested.

(c) Each raft released automatically or by the pilot must be attached to the rotorcraft by a line to keep it alongside the rotorcraft. This line must be weak enough to break before submerging the empty raft to which it is attached.

(d) Each signalling device must be free from hazard in its operation and must be installed in an accessible location.

527.1419 *Ice Protection*

(a) To obtain certification for flight into icing conditions, compliance with this section must be shown.

(b) It must be demonstrated that the rotorcraft can be safely operated in the continuous maximum and intermittent maximum icing conditions determined under Appendix C of Chapter 529 of this Manual within the rotorcraft altitude envelope. An analysis must be performed to establish, on the basis of the rotorcraft's operational needs, the adequacy of the ice protection system for the various components of the rotorcraft.

(c) In addition to the analysis and physical evaluation prescribed in paragraph (b) of this section, the effectiveness of the ice protection system and its components must be shown by flight tests of the rotorcraft or its components in measured atmospheric icing conditions and by one or more of the following tests as found necessary to determine the adequacy of the ice protection system:

(1) Laboratory dry air or simulated icing tests, or a combination of both, of the components or models of the components.

(2) Flight dry air tests of the ice protection system as a whole, or its individual components.

(3) Flight tests of the rotorcraft or its components in measured simulated icing conditions.

(d) The ice protection provisions of this section are considered to be applicable primarily to the airframe. Powerplant installation requirements are contained in Subchapter E of this chapter.

(e) A means must be identified or provided for determining the formation of ice on critical parts of the rotorcraft. Unless otherwise restricted, the means must be available for nighttime as well as daytime operation. The rotorcraft flight manual must describe the means of determining ice formation and must contain information necessary for safe operation of the rotorcraft in icing conditions.

527.1435 *Hydraulic Systems*

(a) Design. Each hydraulic system and its elements must withstand, without yielding, any structural loads expected in addition to hydraulic loads.

(b) Tests. Each system must be substantiated by proof pressure tests. When proof tested, no part of any system may fail, malfunction, or experience a permanent set. The proof load of each system must be at least 1.5 times the maximum operating pressure of that system.

(c) Accumulators. No hydraulic accumulator or pressurized reservoir may be installed on the engine side of any firewall unless it is an integral part of an engine.

527.1457 *Cockpit Voice Recorders*

(a) Each cockpit voice recorder required by the applicable operating rules must be approved, and must be installed so that it will record the following:

(1) Voice communications transmitted from or received in the rotorcraft by radio.

(2) Voice communications of flight crew members on the flight deck.

(3) Voice communications of flight crew members on the flight deck, using the rotorcraft's interphone system.

(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flight crew members using the passenger loudspeaker system, if there is such a system, and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(6) If datalink communication equipment is installed, all datalink communications, using an approved data message set. Datalink messages must be recorded as the output signal from the communications unit that translates the signal into usable data.
(amended 2009/05/11)

(b) The recording requirements of paragraph (a)(2) of this section may be met:

(1) By installing a cockpit-mounted area microphone located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crew members on the flight deck when directed to those stations; or

(2) By installing a continually energized or voice-actuated lip microphone at the first and second pilot stations. The microphone specified in this paragraph must be so located and, if necessary, the preamplifiers and filters of the recorder must be adjusted or supplemented so that the recorded communications are intelligible when recorded under flight cockpit noise conditions and played back. The level of intelligibility must be approved by the Minister. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in paragraph (a) of this section obtained from each of the following sources is recorded on a separate channel:

(1) For the first channel, from each microphone, headset, or speaker used at the first pilot station.

(2) For the second channel, from each microphone, headset, or speaker used at the second pilot station.

(3) For the third channel, from the cockpit-mounted area microphone, or the continually energized or voice-actuated lip microphone at the first and second pilot stations.

(4) For the fourth channel, from:

(i) Each microphone, headset, or speaker used at the stations for the third and fourth crew members; or

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by another channel, each microphone on the flight deck that is used with the passenger loudspeaker system if its signals are not picked up by another channel.

(iii) Each microphone on the flight deck that is used with the rotorcraft's loudspeaker system if its signals are not picked up by another channel.

(d) Each cockpit voice recorder must be installed so that:

(1) It receives its electrical power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads. The cockpit voice recorder must remain powered for as long as possible without jeopardizing emergency operation of the rotorcraft;
(amended 2009/05/11)

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact;

(3) There is an aural or visual means for pre-flight checking of the recorder for proper operation.

(4) Whether the cockpit voice recorder and digital flight data recorder are installed in separate boxes or in a combination unit, no single electrical failure external to the recorder may disable both the cockpit voice recorder and the digital flight data recorder; and
(amended 2009/05/11)

(5) It has an independent power source:
(amended 2009/05/11)

(i) That provides 10 ± 1 minutes of electrical power to operate both the cockpit voice recorder and cockpit-mounted area microphone;
(amended 2009/05/11)

(ii) That is located as close as practicable to the cockpit voice recorder; and
(amended 2009/05/11)

(iii) To which the cockpit voice recorder and cockpit-mounted area microphone are switched automatically in the event that all other power to the cockpit voice recorder is interrupted either by normal shutdown or by any other loss of power to the electrical power bus.
(amended 2009/05/11)

(e) The record container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and consequent heat damage to the record from fire.

(f) If the cockpit voice recorder has a bulk erasure device, the installation must be designed to minimize the probability of inadvertent operation and actuation of the device during crash impact.

(g) Each recorder container must be either bright orange or bright yellow.

(h) When both a cockpit voice recorder and a flight data recorder are required by the operating rules, one combination unit may be installed, provided that all other requirements of this section and the requirements for flight data recorders under this chapter are met. (amended 2009/05/11)

(Change 527-1 (89-01-01))

527.1459 *Flight Recorders*

(a) Each flight recorder required by the applicable operating rules must be installed so that:

(1) It is supplied with airspeed, altitude, and directional data obtained from sources that meet the accuracy requirements of 527.1323, 527.1325, and 527.1327 of this chapter, as applicable;

(2) The vertical acceleration sensor is rigidly attached, and located longitudinally within the approved centre of gravity limits of the rotorcraft;

(3) It receives its electrical power from the bus that provides the maximum reliability for operation of the flight data recorder without jeopardizing service to essential or emergency loads. The flight data recorder must remain powered for as long as possible without jeopardizing emergency operation of the rotorcraft;
(amended 2009/05/11)

(4) There is an aural or visual means for pre-flight checking of the recorder for proper recording of data in the storage medium;

(5) Except for recorders powered solely by the engine-driven electrical generator system, there is an automatic means to simultaneously stop a recorder that has a data erasure feature and prevent each erasure feature from functioning, within 10 minutes after any crash impact; and

(6) Whether the cockpit voice recorder and digital flight data recorder are installed in separate boxes or in a combination unit, no single electrical failure external to the recorder may disable both the cockpit voice recorder and the digital flight data recorder. (amended 2009/05/11)

(b) Each non-ejectable recorder container must be located and mounted so as to minimize the probability of container rupture resulting from crash impact and subsequent damage to the record from fire.

(c) A correlation must be established between the flight recorder readings of airspeed, altitude, and heading and the corresponding readings (taking into account correction factors) of the first pilot's instruments. This correlation must cover the airspeed range over which the aircraft is to be operated, the range of altitude to which the aircraft is limited, and 360 degrees of heading. Correlation may be established on the ground as appropriate.

(d) Each recorder container must:

(1) Be either bright orange or bright yellow;

(2) Have a reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this manual, on or adjacent to the container which is secured in such a manner that they are not likely to be separated during crash impact.

(e) When both a cockpit voice recorder and a flight data recorder are required by the operating rules, one combination unit may be installed, provided that all other requirements of this section and the requirements for cockpit voice recorders under this chapter are met. (amended 2009/05/11)

(Change 527-1 (89-01-01))

527.1461 *Equipment Containing High Energy Rotors*

(a) Equipment containing high energy rotors must meet paragraph (b), (c), or (d) of this section.

(b) High energy rotors contained in equipment must be able to withstand damage caused by malfunctions, vibration, abnormal speeds, and abnormal temperatures. In addition:

(1) Auxiliary rotor cases must be able to contain damage caused by the failure of high energy rotor blades; and

(2) Equipment control devices, systems, and instrumentation must reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It must be shown by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors must be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

(Change 527-1 (89-01-01))

SUBCHAPTER G
OPERATING LIMITATIONS AND INFORMATION

527.1501 *General*

(a) Each operating limitation specified in 527.1503 through 527.1525 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crewmembers as prescribed in 527.1541 through 527.1589.

(Change 527-1 (89-01-01))

Operating Limitations

527.1503 *Airspeed Limitations:General*

(a) An operating speed range must be established.

(b) When airspeed limitations are a function of weight, weight distribution, altitude, rotor speed power, or other factors, airspeed limitations corresponding with the critical combinations of these factors must be established.

(Change 527-1 (89-01-01))

527.1505 *Never-Exceed Speed*

(a) The never-exceed speed, V_{NE} , must be established so that it is:

(1) Not less than 40 knots (CAS); and

(2) Not more than the lesser of:

(i) 0.9 times the maximum forward speeds established under 527.309;

(ii) 0.9 times the maximum speed shown under 527.251 and 527.629; or

(iii) 0.9 times the maximum speed substantiated for advancing blade tip mach number effects.

(b) V_{NE} may vary with altitude, r.p.m., temperature, and weight, if:

(1) No more than two of these variables (or no more than two instruments integrating more than one of these variables) are used at one time; and

(2) The ranges of these variables (or of the indications on instruments integrating more than one of these variables) are large enough to allow an operationally practical and safe variation of V_{NE}.

(c) For helicopters, a stabilized power-off V_{NE} denoted as V_{NE} (power-off) may be established at a speed less than V_{NE} established pursuant to paragraph (a) of this section, if the following conditions are met:

(1) V_{NE} (power-off) is not less than a speed midway between the power-on V_{NE} and the speed used in meeting the requirements of:

(i) 527.65 (b) for single-engine helicopters; and

(ii) 527.67 for multi-engine helicopters.

(2) V_{NE} (power-off) is:

(i) A constant airspeed;

(ii) A constant amount less than power-on V_{NE}; or

(iii) A constant airspeed for a portion of the altitude range for which certification is requested, and a constant amount less than power-on V_{NE} for the remainder of the altitude range.

(Change 527-1 (89-01-01))

527.1509 *Rotor Speed*

(a) Maximum power-off (autorotation). The maximum power-off rotor speed must be established so that it does not exceed 95 percent of the lesser of:

(1) The maximum design r.p.m. determined under 527.309 (b); and

(2) The maximum r.p.m. shown during the type tests.

(b) Minimum power-off. The minimum power-off rotor speed must be established so that it is not less than 105 percent of the greater of:

(1) The minimum shown during the type tests; and

(2) The minimum determined by design substantiation.

(c) Minimum power-on. The minimum power-on rotor speed must be established so that it is:

(1) Not less than the greater of:

(i) The minimum shown during the type tests; and

(ii) The minimum determined by design substantiation; and

(2) Not more than a value determined under 527.33 (a)(1) and (b)(1).

527.1519 *Weight and Centre of Gravity*

The weight and centre of gravity limitations determined under 527.25 and 527.27, respectively, must be established as operating limitations.

527.1521 *Powerplant Limitations*

(a) General. The powerplant limitations prescribed in this section must be established so that they do not exceed the corresponding limits for which the engines are type certificated.

(b) Take-off operation. The powerplant take-off operation must be limited by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value shown during the type tests;

(2) The maximum allowable manifold pressure (for reciprocating engines);

(3) The time limit for the use of the power corresponding to the limitations established in subparagraphs (1) and (2) of this paragraph;

(4) If the time limit in subparagraph (3) of this paragraph exceeds two minutes, the maximum allowable cylinder head, coolant outlet, or oil temperatures;

(5) The gas temperature limits for turbine engines over the range of operating and atmospheric conditions for which certification is requested.

(c) Continuous operation. The continuous operation must be limited by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value shown during the type tests;

(2) The minimum rotational speed shown under the rotor speed requirements in 527.1509 (c); and

(3) The gas temperature limits for turbine engines over the range of operating and atmospheric conditions for which certification is requested.

(d) Fuel grade or designation. The minimum fuel grade (for reciprocating engines), or fuel designation (for turbine engines), must be established so that it is not less than that required for the operation of the engines within the limitations in paragraphs (b) and (c) of this section.

(e) Turbo shaft engine torque. For rotorcraft with main rotors driven by turbo shaft engines, and that do not have a torque limiting device in the transmission system, the following apply:

(1) A limit engine torque must be established if the maximum torque that the engine can exert is greater than:

(i) The torque that the rotor drive system is designed to transmit; or

(ii) The torque that the main rotor assembly is designed to withstand in showing compliance with 527.547 (e).

(2) The limit engine torque established under subparagraph (1) of this paragraph may not exceed either torque specified in subdivision (1)(i) or (ii) of this paragraph.

(f) Ambient temperature. For turbine engines, ambient temperature limitations (including limitations for winterization installations, if applicable) must be established as the maximum ambient atmospheric temperature at which compliance with the cooling provisions of 527.1041 through 527.1045 is shown.

(g) Two and one-half-minute OEI power operation. Unless otherwise authorized, the use of 2½-minute OEI power must be limited to engine failure operation of multi-engine, turbine-powered rotorcraft for not longer than 2½ minutes after failure of an engine. The use of 2½-minute OEI power must also be limited by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum demonstrated during the type tests;

(2) The maximum allowable gas temperature; and

(3) The maximum allowable torque.

(h) Thirty-minute OEI power operation. Unless otherwise authorized, the use of 30-minute OEI power must be limited to multi-engine, turbine-powered rotorcraft for not longer than

30 minutes after failure of an engine. The use of 30-minute OEI power must also be limited by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value demonstrated during the type tests;

(2) The maximum allowable gas temperature; and

(3) The maximum allowable torque.

(i) Continuous OEI power operation. Unless otherwise authorized, the use of continuous OEI power must be limited to multi-engine, turbine-powered rotorcraft for continued flight after failure of an engine. The use of continuous OEI power must also be limited by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value demonstrated during the type tests;

(2) The maximum allowable gas temperature; and

(3) The maximum allowable torque.

(j) Rated 30-second OEI power operation. Rated 30-second OEI power is permitted only on multi-engine, turbine-powered rotorcraft, also certificated for the use of rated 2-minute OEI power, and can only be used for continued operation of the remaining engine(s) after a failure or precautionary shutdown of an engine. It must be shown that following application of 30-second OEI power, any damage will be readily detectable by the applicable inspections and other related procedures furnished in accordance with Section A527.4 of Appendix A of this chapter and Section A533.4 of Appendix A of Chapter 533. The use of 30-second OEI power must be limited to not more than 30 seconds for any period in which that power is used, and by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value demonstrated during the type tests;

(2) The maximum allowable gas temperature; and

(3) The maximum allowable torque.

(k) Rated 2-minute OEI power operation. Rated 2-minute OEI power is permitted only on multi-engine, turbine-powered rotorcraft, also certificated for the use of rated 30-second OEI power, and can only be used for continued operation of the remaining engine(s) after a failure or precautionary shutdown of an engine. It must be shown that following application of 2-minute OEI power, any damage will be readily detectable by the applicable inspections and other related procedures furnished in accordance with Section A527.4 of Appendix A of this chapter and Section A533.4 of Appendix A of Chapter 533. The use of 2-minute OEI power must be limited to not more than 2 minutes for any period in which that power is

used, and by:

(1) The maximum rotational speed, which may not be greater than:

(i) The maximum value determined by the rotor design; or

(ii) The maximum value demonstrated during the type tests;

(2) The maximum allowable gas temperature; and

(3) The maximum allowable torque.

(Change 527-1 (89-01-01))

(Change 527-4)

527.1523 *Minimum Flight Crew*

The minimum flight crew must be established so that it is sufficient for safe operation, considering:

(a) The workload on individual crewmembers ;

(b) The accessibility and ease of operation of necessary controls by the appropriate crewmember; and

(c) The kinds of operation authorized under 527.1525.

527.1525 *Kinds of Operation*

The kinds of operations (such as VFR, IFR, day, night, or icing) for which the rotorcraft is approved are established by demonstrated compliance with the applicable requirements and by the installed equipment.

527.1527 *Maximum Operating Altitude*

The maximum altitude up to which operation is allowed, as limited by flight, structural, powerplant, functional, or equipment characteristics, must be established.

527.1529 *Instructions for Continued Airworthiness*

The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix A to this chapter that are acceptable to the Minister. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first rotorcraft or issuance of a standard certificate of airworthiness, whichever occurs later.

Markings and Placards

527.1541 *General*

(a) The rotorcraft must contain:

(1) The markings and placards specified in 527.1545 through 527.1565; and

(2) Any additional information, instrument markings, and placards required for the safe operation of rotorcraft with unusual design, operating or handling characteristics.

(b) Each marking and placard prescribed in paragraph (a) of this section:

(1) Must be displayed in a conspicuous place; and

(2) May not be easily erased, disfigured, or obscured.

527.1543 *Instrument Markings:General*

For each instrument:

(a) When markings are on the cover glass of the instrument, there must be means to maintain the correct alignment of the glass cover with the face of the dial; and

(b) Each arc and line must be wide enough, and located, to be clearly visible to the pilot.

527.1545 *Airspeed Indicator*

(a) Each airspeed indicator must be marked as specified in paragraph (b) of this section, with the marks located at the corresponding indicated airspeeds.

(b) The following markings must be made:

(1) A red radial line:

(i) For rotorcraft other than helicopters, at V_{NE}; and

(ii) For helicopters, at V_{NE} (power-on).

(2) A red, cross-hatched radial line at V_{NE} (power-off) for helicopters, if V_{NE} (power-off) is less than V_{NE} (power-on).

(3) For the caution range, a yellow arc.

(4) For the safe operating range, a green arc.

527.1547 *Magnetic Direction Indicator*

(a) A placard meeting the requirements of this section must be installed on or near the magnetic direction indicator.

(b) The placard must show the calibration of the instrument in level flight with the engines operating.

(c) The placard must state whether the calibration was made with radio receivers on or off.

(d) Each calibration reading must be in terms of magnetic heading in not more than 45° increments.

(e) If a magnetic non-stabilized direction indicator can have a deviation of more than 10 degrees caused by the operation of electrical equipment, the placard must state which electrical loads, or combination of loads, would cause a deviation of more than 10 degrees when turned on.

527.1549 *Powerplant Instruments*

For each required powerplant instrument, as appropriate to the type of instrument:

(a) Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line;

(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;

(c) Each takeoff and precautionary range must be marked with a yellow arc or yellow line;

(d) Each engine or propeller range that is restricted because of excessive vibration stresses must be marked with red arc or red lines; and

(e) Each OEI limit or approved operating range must be marked to be clearly differentiated from the markings of paragraphs (a) through (d) of this section except that no marking is normally required for the 30-second OEI limit.

(Change 527-1 (89-01-01))

(Change 527-4)

527.1551 *Oil Quantity Indicator*

Each oil quantity indicator must be marked with enough increments to indicate readily and accurately the quantity of oil.

527.1553 *Fuel Quantity Indicator*

If the unusable fuel supply for any tank exceeds one gallon (3.785 litres), or five percent of the tank capacity, whichever is greater, a red arc must be marked on its indicator extending from the calibrated zero reading to the lowest reading obtainable in level flight.

527.1555 *Control Markings*

(a) Each cockpit control, other than primary flight controls or control whose function is obvious, must be plainly marked as to its function and method of operation.

(b) For powerplant fuel controls:

(1) Each fuel tank selector control must be marked to indicate the position corresponding to each tank and to each existing cross feed position;

(2) If safe operation requires the use of any tanks in a specific sequence, that sequence must be marked on, or adjacent to, the selector for those tanks; and

(3) Each valve control for any engine of a multi-engine rotorcraft must be marked to indicate the position corresponding to each engine controlled.

(c) Usable fuel capacity must be marked as follows:

(1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.

(2) For fuel systems having selector controls, the usable fuel capacity available at each selector control position must be indicated near the selector control.

(d) For accessory, auxiliary, and emergency controls:

(1) Each essential visual position indicator, such as those showing rotor pitch or landing gear position, must be marked so that each crew member can determine at any time the position of the unit to which it relates; and

(2) Each emergency control must be red and must be marked as to method of operation.

(e) For rotorcraft incorporating retractable landing gear, the maximum landing gear operating speed must be displayed in clear view of the pilot.

527.1557 *Miscellaneous Markings and Placards*

(a) Baggage and cargo compartments, and ballast location. Each baggage and cargo compartment, and each ballast location must have a placard stating any limitations on contents, including weight, that are necessary under the loading requirements.

(b) Seats. If the maximum allowable weight to be carried in a seat is less than 170 pounds, a placard stating the lesser weight must be permanently attached to the seat structure.

(c) Fuel and oil filler openings. The following apply:

(1) Fuel filler openings must be marked at or near the filler cover with:

(i) The word "fuel";

(ii) For reciprocating engine powered rotorcraft, the minimum fuel grade;

(iii) For turbine engine powered rotorcraft, the permissible fuel designations; and

(iv) For pressure fuelling systems, the maximum permissible fuelling supply pressure and the maximum permissible defuelling pressure.

(2) Oil filler openings must be marked at or near the filler cover with the word "oil".

(3) <u>If placards and markings at the fuel or oil opening include tank capacity, the capacity must be specified in litres. Imperial or U.S. gallons may be included.</u>

FAR: No equivalent text

(d) Emergency exit placards. Each placard and operating control for each emergency exit must be red. A placard must be near each emergency exit control and must clearly indicate the location of that exit and its method of operation.

527.1559 *Limitations Placard*

There must be a placard in clear view of the pilot that specifies the kinds of operations

(such as VFR, IFR, day, night, or icing) for which the rotorcraft is approved.

527.1561 *Safety Equipment*

(a) Each safety equipment control to be operated by the crew in emergency, such as controls for automatic life raft releases, must be plainly marked as to its method of operation.

(b) Each location, such as a locker or compartment, that carries any fire extinguishing, signalling, or other life saving equipment, must be so marked.

527.1565 *Tail Rotor*

Each tail rotor must be marked so that its disc is conspicuous under normal daylight ground conditions.

Rotorcraft Flight Manual and Approved Manual Material

527.1581 *General*

(a) Furnishing information. A Rotorcraft Flight Manual must be furnished with each rotorcraft, and it must contain the following:

(1) Information required by 527.1583 through 527.1589.

(2) Other information that is necessary for safe operation because of design, operating, or handling characteristics.

(b) Approved information. Each part of the manual listed in 527.1583 through 527.1589, that is appropriate to the rotorcraft, must be furnished, verified, and approved, and must be segregated, identified, and clearly distinguished from each unapproved part of that manual.

(c) (*Reserved*)

(d) Table of contents. Each Rotorcraft Flight Manual must include a table of contents if the complexity of the manual indicates a need for it.

(e) Deleted.

(2) Deleted.

(3) Deleted.

(f) Deleted.

(Change 527-4)

527.1583 *Operating Limitations*

(a) Airspeed and rotor limitations. Information necessary for the marking of airspeed and rotor limitations on, or near, their respective indicators must be furnished. The significance of each limitation and of the colour coding must be explained.

(b) Powerplant limitations. The following information must be furnished:

(1) Limitations required by 527.1521.

(2) Explanation of the limitations, when appropriate.

(3) Information necessary for marking the instruments required by 527.1549 through 527.1553.

(c) Weight and loading distribution. The weight and centre of gravity limits required by 527.25 and 527.27, respectively, must be furnished. If the variety of possible loading conditions warrants, instructions must be included to allow ready observance of the limitations.

(d) Flight crew. When a flight crew of more than one is required, the number and functions of the minimum flight crew determined under 527.1523 must be furnished.

(e) Kinds of operation. Each kind of operation for which the rotorcraft and its equipment installations are approved must be listed.

(f) (Reserved)

(g) Altitude. The altitude established under 527.1527 and an explanation of the limiting factors must be furnished.

(h) Ambient temperature. Maximum and minimum ambient temperature limitations must be furnished.

FAR: No equivalent text.

527.1585 *Operating Procedures*

(a) Parts of the manual containing operating procedures must have information concerning any normal and emergency procedures and other information necessary for safe operation, including take-off and landing procedures and associated airspeeds. The manual must contain any pertinent information including:

(1) The kind of take-off surface used in the tests and each appropriate climb-out speed; and

(2) The kind of landing surface used in the tests and appropriate approach and glide airspeeds.

(b) For multi-engine rotorcraft, information identifying each operating condition in which the fuel system independence prescribed in 527.953 is necessary for safety must be furnished, together with instructions for placing the fuel system in a configuration used to show compliance with that section.

(c) For helicopters for which a V_{NE} (power-off) is established under 527.1505 (c), information must be furnished to explain the V_{NE} (power-off) and the procedures for reducing airspeed to not more than the V_{NE} (power-off) following failure of all engines.

(d) For each rotorcraft showing compliance with 527.1353 (g)(2) or (g)(3), the operating procedures for disconnecting the battery from its charging source must be furnished.

(e) If the unusable fuel supply in any tank exceeds five percent of the tank capacity, or one gallon, whichever is greater, information must be furnished which indicates that when the

fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(f) Information on the total quantity of usable fuel for each fuel tank must be furnished.

(g) The airspeeds and rotor speeds for minimum rate of descent and best glide angle as prescribed in 527.71 must be provided.

527.1587 *Performance Information*

(a) The *Rotorcraft Flight Manual* must contain the following information, determined in accordance with 527.49 through 527.87 and 527.143 (c) and (d):
(amended 2009/05/11)

(1) Enough information to determine the limiting height-speed envelope.

(2) Information relative to:

(i) The steady rates of climb and descent, in-ground effect and out-of-ground effect hovering ceilings, together with the corresponding airspeeds and other pertinent information including the calculated effects of altitude and temperatures;
(amended 2009/05/11)

(ii) The maximum weight for each altitude and temperature condition at which the rotorcraft can safely hover in-ground effect and out-of-ground effect in winds of not less than 17 knots from all azimuths. These data must be clearly referenced to the appropriate hover charts. In addition, if there are other combinations of weight, altitude and temperature for which performance information is provided and at which the rotorcraft cannot land and take off safely with the maximum wind value, those portions of the operating envelope and the appropriate safe wind conditions must be stated in the *Rotorcraft Flight Manual*;
(amended 2009/05/11)

(iii) For reciprocating engine-powered rotorcraft, the maximum atmospheric temperature at which compliance with the cooling provisions of 527.1041 through 527.1045 is shown; and

(iv) Glide distance as a function of altitude when autorotating at the speeds and conditions for minimum rate of descent and best glide as determined in 527.71.

(b) The Rotorcraft Flight Manual must contain:

(1) In its performance information section any pertinent information concerning the take-off weights and altitudes used in compliance with 527.51; and

(2) The horizontal takeoff distance determined in accordance with 527.65 (a)(2)(i).

527.1589 *Loading Information*

There must be loading instructions for each possible loading condition between the maximum and minimum weights determined under 527.25 that can result in a centre of gravity beyond any extreme prescribed in 527.27, assuming any probable occupant weights.

APPENDIX A
INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

A527.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by 527.1529.

(b) The Instructions for Continued Airworthiness for each rotorcraft must include the Instructions for Continued Airworthiness for each engine and rotor (hereinafter designated 'products'), for each appliance required by this manual or operating rule, and any required information relating to the interface of those appliances and products with the rotorcraft. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the rotorcraft, the Instructions for Continued Airworthiness for the rotorcraft must include the information essential to the continued airworthiness of the rotorcraft.

(c) The applicant must submit to the Minister a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of products and appliances installed in the rotorcraft will be distributed.

A527.2 Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

A527.3 Content

<u>The Instructions for Continued Airworthiness must contain the following manuals or sections, as appropriate, and information:</u>

FAR: The contents of the manual or manuals must be prepared in the English language. The Instructions for Continued Airworthiness must contain the following manuals or sections, as appropriate, and information:

(a) Rotorcraft maintenance manual or section.

(1) Introduction information that includes an explanation of the rotorcraft's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A description of the rotorcraft and its systems and installations including its engines, rotors, and appliances.

(3) Basic control and operation information describing how the rotorcraft components and systems are controlled and how they operate, including any special procedures and limitations that apply.

(4) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, location of access panels for inspection and servicing, locations of lubrication points,

lubricants to be used, equipment required for servicing, tow instructions and limitations, mooring, jacking, and leveling information.

(b) Maintenance Instructions.

(1) Scheduling information for each part of the rotorcraft and its engines, auxiliary power units, rotors, accessories, instruments, and equipment that provides the recommended periods at which they should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialized maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the rotorcraft.

(2) Troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions.

(3) Information describing the order and method of removing and replacing products and parts with any necessary precautions to be taken.

(4) Other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the center of gravity, lifting and shoring, and storage limitations.

(c) Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided.

(d) Details for the application of special inspection techniques including radiographic and ultrasonic testing where such processes are specified.

(e) Information needed to apply protective treatments to the structure after inspection.

(f) All data relative to structural fasteners such as identification, discard recommendations, and torque values.

(g) A list of special tools needed.

A527.4 Airworthiness Limitations Section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure approved under 527.571. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations section is approved by the Minister and specifies maintenance required by any applicable airworthiness or operating rule unless an alternative program has been approved by the

<u>Minister."</u>

FAR: The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure approved under §27.571. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved."

APPENDIX B
AIRWORTHINESS CRITERIA FOR HELICOPTER INSTRUMENT FLIGHT

I. General

A normal category helicopter may not be type certificated for operation under the instrument flight rules (IFR) of this manual unless it meets the design and installation requirements contained in this Appendix.

II. Definitions

(a) V_{YI} means instrument climb speed, utilized instead of V_Y for compliance with the climb requirements for instrument flight.

(b) V_{NEI} means instrument flight never-exceed speed, utilized instead of V_{NE} for compliance with maximum limit speed requirements for instrument flight.

(c) V_{MINI} means instrument flight minimum speed, utilized in complying with minimum limit speed requirements for instrument flight.

III. Trim

It must be possible to trim the cyclic, collective, and directional control forces to zero at all approved IFR airspeeds, power settings, and configurations appropriate to the type.

IV. Static Longitudinal Stability

(a) General. The helicopter must possess positive static longitudinal control force stability at critical combinations of weight and center of gravity at the conditions specified in paragraph IV(b) or (c) of this Appendix, as appropriate. The stick force must vary with speed so that any substantial speed change results in a stick force clearly perceptible to the pilot. For single-pilot approval, the airspeed must return to within 10 percent of the trim speed when the control force is slowly released for each trim condition specified in paragraph IV(b) of this Appendix.

(b) For single-pilot approval:

(1) *Climb*. Stability must be shown in climb throughout the speed range 20 knots either side of trim with:

(i) The helicopter trimmed at V_{YI};

(ii) Landing gear retracted (if retractable); and

(iii) Power required for limit climb rate (at least 1,000 fpm) at V_{YI} or maximum continuous power, whichever is less.

(2) *Cruise*. Stability must be shown throughout the speed range from 0.7 to 1.1 V_H or V_{NEI}, whichever is lower, not to exceed +20 knots from trim with:

(i) The helicopter trimmed and power adjusted for level flight at 0.9 V_H or 0.9 V_{NEI},

whichever is lower; and

(ii) Landing gear retracted (if retractable).

(3) *Slow cruise.* Stability must be shown throughout the speed range from 0.9 V_{MINI} to 1.3 V_{MINI} or 20 knots above trim speed, whichever if greater, with:

(i) The helicopter trimmed and power adjusted for level flight at 1.1 V_{MINI}; and

(ii) Landing gear retracted (if retractable).

(4) *Descent.* Stability must be shown throughout the speed range 20 knots either side of trim with:

(i) The helicopter trimmed at 0.8 VH or 0.8 VNEI (or 0.8 VLE for the landing gear extended case), whichever is lower;

(ii) Power required for 1,000 fpm descent at trim speed; and

(iii) Landing gear extended and retracted, if applicable.

(5) *Approach.* Stability must be shown throughout the speed range from 0.7 times the minimum recommended approach speed to 20 knots above the maximum recommended approach speed with:

(i) The helicopter trimmed at the recommended approach speed or speeds;

(ii) Landing gear extended and retracted, if applicable; and

(iii) Power required to maintain a 3° glide path and power required to maintain the steepest approach gradient for which approval is requested.

(c) Helicopters approved for a minimum crew of two pilots must comply with the provisions of paragraphs IV (b)(2) and IV (b)(5) of this Appendix.

V. Static Lateral-Directional Stability

(a) Static directional stability must be positive throughout the approved ranges of airspeed, power and vertical speed. In straight, steady sideslips up to ±10° from trim, directional control position must increase without discontinuity with the angle of sideslip, except for a small range of sideslip angles around trim. At greater angles up to the maximum sideslip angle appropriate to the type, increased directional control position must produce an increased angle of sideslip. It must be possible to maintain balanced flight without exceptional pilot skill or alertness.
(amended 2009/05/11)

(b) During sideslips up to ±10° from trim throughout the approved ranges of airspeed, power and vertical speed, there must be no negative dihedral stability perceptible to the pilot through lateral control motion or force. Longitudinal cyclic movement with sideslip must not be excessive.
(amended 2009/05/11)

VI. Dynamic Stability

(a) For single-pilot approval:

(1) Any oscillation having a period of less than 5 seconds must damp to ½ amplitude in not more than one cycle.

(2) Any oscillation having a period of 5 seconds or more but less than 10 seconds must damp to ½ amplitude in not more than two cycles.

(3) Any oscillation having a period of 10 seconds or more but less than 20 seconds must be damped.

(4) Any oscillation having a period of 20 seconds or more may not achieve double amplitude in less than 20 seconds.

(5) Any aperiodic response may not achieve double amplitude in less than 6 seconds.

(b) For helicopters approved with a minimum crew of two pilots:

(1) Any oscillation having a period of less than 5 seconds must damp to ½ amplitude in not more than two cycles.

(2) Any oscillation having a period of 5 seconds or more but less than 10 seconds must be damped.

(3) Any oscillation having a period of 10 seconds or more may not achieve double amplitude in less than 10 seconds.

VII. Stability Augmentation System (SAS)

(a) If a SAS is used, the reliability of the SAS must be related to the effects of its failure. Any SAS failure condition that would prevent continued safe flight and landing must be extremely improbable. It must be shown that, for any failure condition of the SAS that is not shown to be extremely improbable:
(amended 2009/05/11)

(1) The helicopter is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved IFR operating limitations; and
(amended 2009/05/11)

(2) The overall flight characteristics of the helicopter allow for prolonged instrument flight without undue pilot effort. Additional unrelated probable failures affecting the control system must be considered. In addition:
(amended 2009/05/11)

(i) The controllability and manoeuvrability requirements in Subchapter B of this Chapter must be met throughout a practical flight envelope;
(amended 2009/05/11)

(ii) The flight control, trim and dynamic stability characteristics must not be impaired below a level needed to allow continued safe flight and landing; and
(amended 2009/05/11)

(iii) The static longitudinal and static directional stability requirements of Subchapter B must be met throughout a practical flight envelope.
(amended 2009/05/11)

(b) The SAS must be designed so that it cannot create a hazardous deviation in flight path or produce hazardous loads on the helicopter during normal operation or in the event of malfunction or failure, assuming corrective action begins within an appropriate period of time. Where multiple systems are installed, subsequent malfunction conditions must be considered in sequence unless their occurrence is shown to be improbable.

VIII. Equipment, Systems, and Installation

The basic equipment and installation must comply with FAR sec. 29.1303[Amdt. 29-14], AWM 529.1431 and 529.1433[First Edition], with the following exceptions and additions: (amended 2012/03/27)

(a) Flight and Navigation Instruments.

(1) A magnetic gyro-stabilized direction indicator instead of a gyroscopic direction indicator required by 529.1303 (h); and

(2) A standby attitude indicator which meets the requirements of 529.1303 (g)(1) through (7) instead of a rate-of-turn indicator required by 529.1303 (g). For two-pilot configurations, one pilot's primary indicator may be designed for this purpose. If standby batteries are provided, they may be charged from the aircraft electrical system if adequate isolation is incorporated.

(b) Miscellaneous requirements.

(1) Instrument systems and other systems essential for IFR flight that could be adversely affected by icing must be adequately protected when exposed to the continuous and intermittent maximum icing conditions defined in Appendix C of Chapter 529 of this Manual, whether or not the rotorcraft is certificated for operation in icing conditions.

(2) There must be means in the generating system to automatically de-energize and disconnect from the main bus any power source developing hazardous over-voltage.

(3) Each required flight instrument using a power supply (electric, vacuum, etc.) must have a visual means integral with the instrument to indicate the adequacy of the power being supplied.

(4) When multiple systems performing like functions are required, each system must be grouped, routed, and spaced so that physical separation between systems is provided to ensure that a single malfunction will not adversely affect more than one system.

(5) For systems that operate the required flight instruments at each pilot's station:

(i) Only the required flight instruments for the first pilot may be connected to that operating system;

(ii) Additional instruments, systems, or equipment may not be connected to an operating system for a second pilot unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any

malfunction of the additional instruments, systems, or equipment which is not shown to be extremely improbable;

(iii) The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments will remain available to a pilot, without additional crew member action, after any single failure or combination of failures that is not shown to be extremely improbable; and

(iv) For single-pilot configurations, instruments which require a static source must be provided with a means of selecting an alternate source and that source must be calibrated.

IX. Rotorcraft Flight Manual

A Rotorcraft Flight Manual or Rotorcraft Flight Manual IFR Supplement must be provided and must contain:

(a) Limitations. The approved IFR flight envelope, the IFR flight crew composition, the revised kinds of operation, and the steepest IFR precision approach gradient for which the helicopter is approved;

(b) Procedures. Required information for proper operation of IFR systems and the recommended procedures in the event of stability augmentation or electrical system failures; and

(c) Performance. If V_{YI} differs from V_Y, climb performance at V_{YI} and with maximum continuous power throughout the ranges of weight, altitude, and temperature for which approval is requested.

APPENDIX C
CRITERIA FOR CATEGORY A

C527.1 General

A small multi-engine rotorcraft may not be type certificated for Category A operation unless it meets the design installation and performance requirements contained in this appendix in addition to the requirements of this chapter.

(Change 527-4)

C527.2 Applicable Chapter 529 Sections

The following sections of Chapter 529 of this Manual must be met in addition to the requirements of this chapter:

529.45 (a), and (b)(2) - General

529.49 (a) - Performance at Minimum Operating Speed

529.51 - Take-off Data:General

529.53 - Takeoff:Category A

529.55 - Take-off Decision Point:Category A

529.59 - Take-off Path:Category A

529.60 - Elevated Heliport Take-off Path:Category A

529.61 - Take-off Distance:Category A

529.62 - Rejected Takeoff:Category A

529.64 - Climb:General

529.65 (a) - Climb:AEO

529.67 (a) - Climb:OEI

529.75 - Landing:General

529.77 - Landing Decision Point:Category A

529.79 - Landing:Category A

529.81 - Landing Distance (Ground Level Sites):Category A

529.85 - Balked Landing:Category A

529.87 (a) - Height-Velocity Envelope

529.547 (a) and (b) - Main and Tail Rotor Structure

529.861 (a) - Fire Protection of Structure, Controls, and Other Parts

529.901 (c) - Powerplant:Installation

529.903 (b) (c) and (e) - Engines

529.908(a) - Cooling Fans

529.917 (b) and (c)(1) - Rotor Drive System:Design

529.927 (c)(1) - Additional Tests

529.953 (a) - Fuel System Independence

529.1027 (a) - Transmission and Gearboxes:General

529.1045 (a)(1), (b), (c), (d), and (f) - Climb Cooling Test Procedures

529.1047 (a) - Takeoff Cooling Test Procedures

529.1181 (a) - Designated Fire Zones:Regions Included

529.1187 (e) - Drainage and Ventilation of Fire Zones

529.1189 (c) - Shut-off Means

529.1191 (a)(1) - Firewalls

529.1193 (e) - Cowling and Engine Compartment Covering

529.1195 (a) and (d) - Fire Extinguishing Systems (one shot)

529.1197 - Fire Extinguishing Agents

529.1199 - Extinguishing Agent Containers

529.1201 - Fire Extinguishing System Materials

529.1305 (a) (6) and (b) - Powerplant Instruments

529.1309 (b)(2) (i) and (d) - Equipment, Systems, and Installations

529.1323 (c)(1) - Airspeed Indicating System

529.1331 (b) - Instruments Using a Power Supply

529.1351 (d)(2) - Electrical Systems and Equipment:General (Operation Without Normal Electrical Power)

529.1587 (a) - Performance Information

Information Note:
In complying with the paragraphs listed in paragraph C527.2 above, relevant material in the AC ''Certification of Transport Category Rotorcraft'' should be used.

(Change 527-4)

APPENDIX D
HIRF ENVIRONMENTS AND EQUIPMENT HIRF TEST LEVELS

(amended 2008/10/30)

This appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems in accordance with 527.1317. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square (RMS) units measured during the peak of the modulation cycle.
(amended 2008/10/30)

(a) HIRF environment I is specified in the following table:
(amended 2008/10/30)

Table I — HIRF Environment I

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	50	50
100 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2000	200
2 GHz – 6 GHz	3000	200
6 GHz – 8 GHz	1000	200
8 GHz – 12 GHz	3000	300
12 GHz – 18 GHz	2000	200
18 GHz – 40 GHz	600	200
In this table, the higher field strength applies at the frequency band edges		
(amended 2008/10/30)		

(b) HIRF environment II is specified in the following table:
(amended 2008/10/30)

Table II — HIRF Environment II

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 500 kHz	20	20
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1300	160
2 GHz – 4 GHz	3000	120
4 GHz – 6 GHz	3000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150
In this table, the higher field strength applies at the frequency band edges		
(amended 2008/10/30)		

(c) HIRF environment III is specified in the following table:
(amended 2008/10/30)

Table III — HIRF Environment III

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 100 kHz	150	150
100 kHz – 400 MHz	200	200
400 MHz – 700 MHz	730	200
700 MHz – 1 GHz	1400	240
1 GHz – 2 GHz	5000	250

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
2 GHz – 4 GHz	6000	490
4 GHz – 6 GHz	7200	400
6 GHz – 8 GHz	1100	170
8 GHz – 12 GHz	5000	330
12 GHz – 18 GHz	2000	330
18 GHz – 40 GHz	1000	420
In this table, the higher field strength applies at the frequency band edges		
(amended 2008/10/30)		

(d) Equipment HIRF Test Level 1
(amended 2008/10/30)

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with continuous wave (CW) and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current shall start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibels (dB) per frequency decade to a minimum of 30 mA at 500 kHz.
(amended 2008/10/30)

(2) From 500 kHz to 40 MHz, the conducted susceptibility current shall be at least 30 mA.
(amended 2008/10/30)

(3) From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 30 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 3 mA at 400 MHz.
(amended 2008/10/30)

(4) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/m) peak with CW and 1 kHz square wave modulation with 90 percent depth or greater.
(amended 2008/10/30)

(5) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal shall be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.
(amended 2008/10/30)

(e) Equipment HIRF Test Level 2
(amended 2008/10/30)

Equipment HIRF test level 2 is HIRF environment II in table II of this appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing shall cover the frequency band of 10 kHz to 8 GHz.
(amended 2008/10/30)

(f) Equipment HIRF Test Level 3
(amended 2008/10/30)

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 7.5 mA at 500 kHz.
(amended 2008/10/30)

(2) From 500 kHz to 40 MHz, use conducted susceptibility tests at a minimum of 7.5 mA.
(amended 2008/10/30)

(3) From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 7.5 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 0.75 mA at 400 MHz.
(amended 2008/10/30)

(4) From 100 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 5 V/m.
(amended 2008/10/30)

Transport Canada Transports Canada

TP 6197E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 529 - TRANSPORT CATEGORY ROTORCRAFT

Canada

Available through your local bookseller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: (613) 954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: http://publications.communication.gc.ca

Catalogue No. : T51-15-529-2003E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2003-4 (2003/12/01)	Jan. 22/04	[illegible]
2006-2 (20 /12/06)	Jan 31/07	[illegible]
2008-1 (2008/06/30)	2012/03/24	[illegible]
2008-2 (2008/12/01)	" "	[illegible]
2009-1 (2009/06/30)	" "	[illegible]
2009-2 (2009/12/01)	"	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL CHAPTER 529 - TRANSPORT CATEGORY ROTORCRAFT

Table of Contents

Preamble

General

The content of this chapter is based on the United States *Code of Federal Regulations*, Title 14, Chapter 1, Part 29 entitled, Airworthiness Standards, Transport Category Rotorcraft. These United States airworthiness standards have been used and adapted as the model for the Canadian standards supplemented by additional airworthiness requirements based on Canadian experience and required for Canadian aviation purposes.

The FAR numbering system is used; the Canadian standards bears the same number as the FAR equivalent, prefixed by the number "5", as this chapter forms part of Series 5 of the Canadian Aeronautics Code.

* * * * * * * * * * * * *

First Edition **Effective July 1, 1986**

The Standards in this chapter are presented in a two-column format with the United States FAR in the left column and the Canadian standards in the right column. Chapters, subchapters, sections and subsections numbering and headings are opposite to the equivalent FAR. Where the Canadian standard is identical to the FAR, The words "No Variation" appear; where a variation exits, the affected part of text is printed opposite to the FAR with all changes underlined.

The first issue of this chapter is based on FAR Part 29, up to and including amendment 29-24. In addition to administrative changes (e.g., Administrator = Minister; part = Chapter) and the deletion of references to operating FARs, the Canadian variations included in this edition are as follows:

* Rotorcraft Operations after Ground Cold Soak, section 529.1301-1;

* Miscellaneous Markings and Placards, use of metric units, section 529.1557, paragraph (c)(3);

* *Rotorcraft Flight Manual*, section 529.1581, use of metric units, paragraph (e), and reference to operating rules, paragraph (f); and

* Operating Limitations, Ambient temperature, section 529.1583, paragraph (h).

In addition, the applicable Airworthiness Manual Advisories (AMA) are attached to this chapter:

* AMA 500C/1 Aircraft or Equipment Incorporating Digital Computer Technology, dated 1 May 1986.

* AMA 500C/2 Multipurpose Electronic Flight Deck Display Systems, dated 1 May 1986.

* AMA 500C/3 Fire Protection - Ignition Sources, dated 1 May 1986.

* AMA 500C/4 Portable Fire Extinguishers for Use in Aircraft, dated 25 March 1986.

* * * * * * * * * * * * *

Change 529-1 **Effective January 1, 1989**

This Change incorporates the following amendments to the United States *Code of Federal Regulations*, Title 14, Chapter 1, Part 29:

Amendment 29-25 "Cockpit Voice Recorders and Flight Data Recorders" provides standards governing the design and installation of cockpit voice recorders and flight data recorders for rotorcraft. Generally, the requirements and parameters for flight recorders are upgraded to the level of the most sophisticated systems available; the use of digital recording equipment will henceforth become the norm. Additionally, uninterrupted sound recording will be required in cockpit voice recorders. At the date of effectivity of this amendment, Air Navigation Order, Series II, No. 13 and 14 do not require cockpit voice recorders or flight data recorders in rotorcraft. The standards in Sections 529.1457 and 529.1549 will not be applicable unless specifically required in the type certificate basis, a unique operational requirement, or voluntary compliance is requested and approved by Transport Canada.

Amendment 29-26 "Rotorcraft Regulatory Review Program; Amendment No. 3" adopts new and revised airworthiness standards for the powerplant and rotor drive systems to changing rotorcraft certification requirements brought on by technological advances. Amendment 29-26 is adopted with the exception of the amendment to 529.1093 subparagraph (b)(1). A variation is presently being developed to require all rotorcraft to demonstrate some capability to operate during flight encounters with snow, without adverse effect on engine operation. Pending approval of this variation the present text of 529.1093(b)(1) is reprinted on the right side of the page.

***Information Note**: Changes are identified by brackets [ ]; editorial alterations and typographical corrections are not identified.*

* * * * * * * * * * * * *

Change 529-2 **Effective February 1, 1992**

This change incorporates the following amendments to the United States *Code of Federal Regulations*, Title 14, Chapter 1, Part 29:

Amendment 29-27 "Revision of General Operating Flight Rules". This amendment changes a cross reference to Part 91 in Appendix A of Part 29, and therefore it is not applicable in Canada. This FAR change is part of a larger reorganization of the general U.S. operating and flight rules to make them more understandable and easier to use.

Amendment 29-28 "Transport Category Rotorcraft Structural Fatigue Evaluation" (published October 27, 1989). This amendment adds flaw tolerance requirements to the requirements for fatigue evaluations of structures. The amendment also extends the requirements for fatigue evaluations for flight structures only to all critical structures, including landing gear, and requires consideration of operations having a high number of power cycles per hours. This amendment is intended to avoid or reduce catastrophic fatigue failures in transport category rotorcraft.

Amendment 29-29 “Occupant Restraint in Normal and Transport Category Rotorcraft”. This amendment adds two dynamic crash impact design conditions for seat and occupant restraint systems and increases the static design load factors for seating devices and items of mass in the cabin or adjacent to the cabin. This amendment also prescribes a shoulder harness for each occupant and adopts human impact injury criteria as a measure for occupant protection for dynamic crash impact conditions.

Amendment 29-30 “Rotorcraft Regulatory Review Program Amendment No. 4“. This amendment introduces new and revised airworthiness standards for certification of airframe and related equipment on both normal and transport category rotorcraft. This amendment grew out of a rotorcraft regulatory review program and the recognition by both the U.S. government and industry that updated safety standards are needed. The amendment provides a high level of safety in design requirements, while removing certain unnecessary existing burdens.

Amendment 29-31 “Rotorcraft Airworthiness Amendments Based on European Joint Airworthiness Requirements Proposals“. This amendment introduces changes to the airworthiness standards for systems propulsion and airframe for both normal and transport category rotorcraft. In addition, the amendment introduces safety improvements, clarify existing regulations, and standardize terminology. The changes are based on some of the proposals that were submitted to the FAA by the European Airworthiness Authorities. The amendment is intended to achieve increased commonality of airworthiness standards among the respective countries. Transport Canada, Aviation Group shares this objective of international harmonization of airworthiness standards for the certification of civil aircraft.

Amendment 29-32 “Shoulder Harnesses in Normal and Transport Category Rotorcraft”. This amendment requires the installation and use of shoulder harnesses at all seats of rotorcraft manufactured after September 1992. In right column a Note states that the applicable Canadian retroactive requirements are being published in Air Navigation Order, Series II, No. 2.

In addition, this Change also introduces:

A Canadian variation to section 529.1093 subparagraph (b)(1). In the Preamble to Change 529-1, it was annotated against FAR amendment 29-26, that the change in requirements for flight tests in snow conditions was not applicable in Canada and that a new requirement was under development. The variation published in this Change has been subjected to consultation with Canadian aviation industry and has received general acceptance. This variation is supplemented by the publication of advisory material AMA 500C/7, dated 27 July 1990, which provides guidance on acceptable means of compliance.

The revision of previous preambles for completeness and clarity.

The publication of the following new or revised advisory material:

AMA 500C/5B Aircraft Operation After Ground Cold Soak dated March 2, 1990.

AMA 500C/6 Lighting Protection of Aircraft Fuel Systems dated Oct. 27, 1989.

AMA 500C/7 Induction System Snow Protection dated July 27, 1990

AMA 500C/8 Composite Aircraft Structures dated Jan. 8, 1991.

Change 529-3 **Effective January 3, 1994**

This change is the result of FAA NPRM 90-24. The proposed amendment entitled "Crash Resistant Fuel Systems in Normal and Transport Category Rotorcraft" intends to improve the survivability from helicopter crashes resulting in post crash fires. In anticipation of the final rule incorporating this amendment into FAR Part 29 and in harmonization with the JAA, Transport Canada has adopted this proposed amendment. The standards intend to minimize spillage of fuel (and other flammable fluids) near ignition sources, minimize potential ignition sources and improve evacuation time needed for crew and passengers to escape a post crash fire.

The adoption of this rule was object of NPA 93-03.

* * * * * * * * * * * *

Second Edition **Change 529-4**

1. General **Published December 1, 2003**

This change introduces a new format that eliminates the left-hand column containing the FARs. The Canadian standards in this chapter are now presented in a full-page format. Canadian variations and major differences in textual references from the FARs are underlined with the FAR text following in an information note. This change introduces a new amendment format and as a result the change number and date of affected pages has been removed from the bottom of the page. This new amendment format was introduced in chapter 525 of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following changes to the amendment procedures are introduced in this Change 529-4:

* the preamble will be the focal point regarding the sections affected by this change. The change number will no longer be provided at the end of an amended section. Rather, for the current change only, the amended text will be followed by an amendment tag identifying the coming into force date of the provision. (example: amended (2003-06-01);).

* brackets "[ ]" will no longer be used to identify new or revised text. On the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted, but followed by an electronic link to the previous version of the modified text. (example: amended 2003-06-01; previous version)

* the preamble will include tables of change information. These tables will include the Notices of Proposed Amendments (NPAs) with the corresponding amended sections.

With the incorporation of these changes, the entire chapter is republished in a Second Edition.

2. FAR Amendments

This amendment incorporates the technical standards contained in the following amendments to the United States Code of Federal Regulations, Title 14, Chapter 1, Part 29, for which Notices of Proposed Amendments (NPAs) were issued to solicit industry comments on their adoption by reference.

These NPAs were issued under the simplified procedure for the amendment of the design standards of the *Airworthiness Manual*, approved by the Civil Aviation Regulatory Committee on October 15, 1997 and are noted in the following FAR amendment description.

FAR Amendment 29-33 **Effective March 25, 1995**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **1994-015**	▪ 529.1415

This amendment entitled "Emergency Locator Transmitters" requires that newly installed emergency locator transmitters be of an improved design that meets the requirements of a revised TSO or later TSOs issued for ELTs.

FAR Amendment 29-34 **Effective March 25, 1995**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ **1994-014**	▪ 529.67 ▪ 529.923 ▪ 529.1143 ▪ 529.1305 ▪ 529.1521 ▪ 529.1549

This amendment entitled "New Rotorcraft 30 second/2-minute One Engine Inoperative Power Ratings", adopts new and revised Airworthiness Standards by incorporating optional One-Engine-Inoperative (OEI) power ratings for multi-engine Turbine-Powered

Rotorcraft. These standards enhance rotorcraft safety after an engine failure or shutdown by providing higher OEI power.

FAR Amendment 29-35 **Effective June 5, 1995**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 1995-002	▪ 529.952 ▪ 529.963 ▪ 529.967 ▪ 529.973 ▪ 529.975

This amendment entitled "Crash Resistant Fuel Systems in Normal and Transport Category Rotorcraft" adds comprehensive crash resistant fuel system design and test criteria. These new standards will minimize fuel spillage near ignition sources and potential ignition sources, thus reducing the post crash fire hazard to the occupants.

Concurrently with the adoption by reference of this amendment, a Canadian variation to section 529.975 subparagraph (a) (7) was approved to more accurately reflect the tendency of helicopter to rollover during crash landing, by deleting the following phrase: "unless a rollover is shown to be extremely remote."

The adoption by reference of this amendment, including the Canadian variation.

Information Note*: Prior to the adoption of this amendment, Transport Canada adopted FAA NPRM 90-24 and incorporated the proposed rule without the above variation at Change 3 of this Chapter.*

Also refer to Amendment 29-42.

FAR Amendment 29-36 **Effective April 7, 1997**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 1996-005	▪ 529.903

This amendment entitled "Rotorcraft Engine Rotor Burst Protection" introduces new requirements to transport category rotorcraft design standards to improve the safety level and minimize the hazards resulting from turbine engine rotor failure.

FAR Amendment 29-37

Information Note: *Amendment FAR 29-37 "Revision of Authority Citation" was not adopted as it dealt with the recodification of the US Federal Aviation Act of 1958 and is therefore not applicable.*

FAR Amendment 29-38 **Effective April 7, 1997**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ 1996-002	▪ 529.561 ▪ 529.901

This amendment entitled "Occupant Protection in Normal and Transport Category Rotorcraft" significantly increases the ultimate design load factor for restraining heavy items located above or behind the occupied area during emergency landings.

FAR Amendment 29-39 **Effective April 7, 1997**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 1996-005	▪ 529.1 ▪ 529.49 ▪ 529.51 ▪ 529.53 ▪ 529.55 ▪ 529.59 ▪ 529.60 ▪ 529.61 ▪ 529.62 ▪ 529.64 ▪ 529.65 ▪ 529.67 ▪ 529.73 ▪ 529.75

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
	▪ 529.77 ▪ 529.79 ▪ 529.81 ▪ 529.83 ▪ 529.85 ▪ 529.87 ▪ 529.917 ▪ 529.1323 ▪ 529.1587

This amendment entitled "Transport Category Rotor Burst Performance" revises the airworthiness standards for the performance of transport category rotorcraft. These changes define more clearly the factors for determining takeoff, climb and landing performance requirements and improves the safety level. In addition, some clarifications of and additions to the provisions of Amendment 29-21 are also included.

FAR Amendment 29-40 **Effective April 7, 1997**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ **1996-003**	▪ 529.547 ▪ 529.610 ▪ 529.629 ▪ 529.631 ▪ 529.923 ▪ 529.1305 ▪ 529.1309 ▪ 529.1351 ▪ 529.1587 ▪ B529.8

This amendment entitled "Rotorcraft Regulatory Changes Based on European Joint Aviation Requirements" revises the airworthiness standards for performance, systems,

propulsion, and airframes for normal and transport category rotorcraft. In addition, this amendment increases the regulatory safety level, clarifies existing regulations, and standardizes terminology. These changes are based on standards incorporated by the European Joint Aviation Authorities (JAA) for Joint Aviation Requirements (JAR) 27 and 29 and are intended to harmonize airworthiness standards among the respective countries.

FAR Amendment 29-41 **Effective October 29, 1998**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 1998-175	▪ 529.351 ▪ 529.391 ▪ 529.562 ▪ 529.621 ▪ 529.1125 ▪ 529.1521

This technical amendment amends the airworthiness standards for normal and transport category rotorcraft. As published, the final regulations contain some incorrect word usage and omissions, misspellings and incorrect references that may prove to be misleading and are in need of correction.

FAR Amendment 29-42 **Effective November 23, 1998**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 1998-177	▪ 529.625 ▪ 529.785 ▪ 529.923 ▪ 529.975 ▪ 529.1329 ▪ 529.1351 ▪ 529.1359

This amendment entitled "Harmonization of Miscellaneous Rotorcraft Regulations" amends the airworthiness standards to require a cockpit indication of autopilot operating mode to the pilots for certain autopilot configurations, to clarify the burn test requirements for electrical wiring for transport category rotorcraft, and to provide a new requirement for

an electrical wire burn test for normal category rotorcraft. The rule also adds a 1.33 fitting factor structural strength requirements to the attachment of litters and berths.

With amendment 29-42 the FAA also harmonized their requirement of paragraph 29.975 (a)(7) with the Canadian variation 529.975 (a) (7) introduced at amendment 29-35. The text is presently harmonized and the variation does not exist any longer, effective on the date of adoption of this amendment.

FAR Amendment 29-43 **Effective December 1, 1999**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ **1999-171**	▪ 529.25 ▪ 529.865

This amendment entitled "Rotorcraft Load Combination Safety Requirements" revises the airworthiness standards to provide improved safety standards for rotorcraft load combination (RLC) certification. Several accidents occurred in the past 15 years involving the carriage of humans external to the rotorcraft. These amendments provide an increased level of safety in the carriage of humans and are harmonized to international standards. Also, these amendments address advances in technology and significant changes in equipment employed in external load operations.

FAR Amendment 29-44 **Effective December 1, 1999**

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ **1999-172**	▪ 529.59 ▪ 529.62 ▪ 529.67 ▪ 529.77 ▪ 529.81 ▪ 529.85 ▪ 529.1323 ▪ 529.1587

This amendment entitled "Transport Category Rotorcraft Performance" revises the airworthiness standards for Transport Category rotorcraft by making several non-substantive clarification changes to the wording and by correcting various

non-substantive errors in the performance requirements sections.

FAR Amendment 29-45

***Information Note**: Amendment 29-45, entitled "Critical Parts" is not included in this change issue. This amendment has been adopted by reference and is effective as of the 23 June 2003.*

FAR Amendment 29-46

***Information Note**: Amendment 29-46, "Revision of Authority Citation" adopts new authority citation for Title 14 of the United States Code of Federal Regulations. It does not apply in Canada.*

FAR Amendment 29-47 **Effective October 24, 2001**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2001-253**	▪ 529.397

This amendment entitled "Rotorcraft Airworthiness Standards" corrects errors in the airworthiness standards for normal and transport category rotorcrafts that have long been recognized as being misleading and in need of clarification. The particular sections being amended relate to limit pilot forces.

3. CARAC Proposed Amendment Recommendations

This amendment also implements the recommendations of CARAC Working Group 527/529.

In 1996 the integration of the existing Design Standards of this Manual into the new *Canadian Aviation Regulations* (CARs), Part V was delayed as a result of a request by Canadian aviation industry to review these standards, in particular the Canadian variations, and all associated Canadian advisory material (AMAs) for their accuracy and appropriateness.

Due to the time frame for CARs implementation, the CARAC Airworthiness Technical Committee V formed several Working Groups made up of industry and Transport Canada specialists to review those variations, AMAs and any applicable Special Conditions and make recommendations to the Committee for their disposition.

The final report of the 527/529 Working Group was completed in July 1999 and presented to CARAC Technical Committee V in September 1999. The Civil Aviation Regulatory Committee (CARC) approved all the recommendations on 10 December 1999.

Therefore, this change includes:

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ **1995-001**	▪ 529.807 ▪ 529.813

These requirements improve exit standards for passenger emergency evacuation in cases where the rotorcraft is resting on its side. These variations were subjected to consultation with Canadian aviation industry through NPA 95-01 and received general acceptance.

The Working Group 527/529 reviewed this variation and recommended changes that were submitted to industry consultation by means of NPA 99-152. The present Canadian variations at paragraph 529.807 (c) and 529.813 (d) were approved by CARC on 10 December 1999. A new Advisory Circular (529-xxx series) contains acceptable means of compliance with these requirements.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2001-101**	▪ 529.1093

The Canadian variation was amended to correct the terminology.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2000-102** ▪ **2001-015**	▪ 529.1581

The Canadian variation in 529.1581(e) and (f) was cancelled.

The Canadian variation 529.975 (b) was also cancelled as explained in the text of amendment 29-42.

4. Miscellaneous Changes

This change also includes editorial corrections, including the update of cross-references to CARs (e.g. 529.1).

Due to the consolidation of all regulatory requirements previously found in the *Air Regulations and Air Navigation Orders* into the *Canadian Aviation Regulations*, administrative changes are included in this amendment to update the regulatory references and terminologies (e.g. Type Certificate instead of Type Approval).

Change 529-5 **Published: December 30, 2006**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 29:

FAR Amendment 29-45	Effective: June 23, 2003
Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2002-063**	▪ 529.602

This amendment entitled "Critical Parts" adopts by reference the rotorcraft critical parts requirements of FAR amendment 29-45, dated 25 October 1999, and incorporates the FAA final rule in AWM Chapter 529 in order to harmonize with both the FAA and JAA (now the European Aviation Safety Agency (EASA)).

In 1999, FAA and JAA issued harmonized requirements dealing with the quality assurance of critical parts of rotorcraft. The new requirements contain a definition of "Critical Parts" and require to show compliance with the quality assurance requirements of FAR or JAR Part 21 (superseded by EASA IR Part 21). The FAA and JAA/EASA rules and related advisory material are fully harmonized.

The objective of the rule is to create a rotorcraft critical part list to ensure that critical parts are controlled during design, substantiation, manufacturing and throughout their service life (maintenance and modifications).

Information Note*: FAA and JAA published advisory material: AC/ACJ 29.602. This Advisory Circular is acceptable in Canada.*

Change 529-6 **Published: June 30, 2008**

This change incorporates the following amendments to the United States Code of Federal Regulations, Title 14, Chapter I, Part 29:

529.67 Climb: One-Engine-Inoperative (OEI)	Effective: July 16, 2007
Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2007-018**	▪ 529.67

This amendment entitled "Climb: One-Engine Inoperative" adopts by reference a correction to AWM Chapter 529 paragraph 529.67(a)(2), which has not yet been captured. The FAA Federal Register volume 64, page 45337, dated 19 August 1999 provided a change to the noted paragraph.

Paragraph (a)(2)(ii) is [now] deleted because the requirement is previously stated in Sec. 29.64. The deletion of paragraph (a)(2)(ii) resulted in an editorial renumbering of paragraphs (iii) and (iv) as (ii) and (iii) respectively.

The above correction affects only the English text of the CARs since the error originated with the FARs. As a result, the French text is untouched. This explains the discrepancy associated with the Amendment dates tags for the English text (July 16, 2007) and the French text (April 7, 1997).

Change 529-7 **Published: December 30, 2008**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 29:

Information Note: *There is presently no FAR Amendment 29-48 as this number was skipped in the U.S. 14 CFR part 29.*

FAR Amendment 29-49	**Effective: October 30, 2008**
Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ 2008-005	▪ 529.1317 ▪ Appendix E

This amendment entitled "High-Intensity Radiated Fields (HIRF) Protection for Aircraft Electrical and Electronic Systems revises the airworthiness standards for Transport Category Rotorcraft. This action is necessary due to the vulnerability of aircraft electrical and electronic systems and the increasing use of high-power radio frequency transmitters. It is intended to create a safer operating environment for civil aviation by protecting aircraft and their electrical and electronic systems from the adverse effects of HIRF.

Change 529-8 **Published: June 30, 2009**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 29:

FAR Amendment 29-50	**Effective: May 11, 2009**
Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ 2008-066	▪ 529.1457 ▪ 529.1459

This amendment entitled "Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Standards" revises the airworthiness standards for Transport Category

Rotorcraft. This amendment increases the duration of certain CVR recordings, requires physical separation of the DFDR and CVR, improves the reliability of the power supplies to both the CVR and DFDR, and requires that certain datalink communications received on an aircraft be recorded if datalink communication equipment is installed. This amendment is based on recommendations issued by the National Transportation Safety Board following its investigations of several accidents and incidents. These changes to CVR and DFDR systems are intended to improve the quality and quantity of information recorded, and increase the potential for retaining important information needed for accident and incident investigations.

FAR Amendment 29-51	**Effective: May 11, 2009**
Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ 2008-069	▪ 529.25 ▪ 529.143 ▪ 529.173 ▪ 529.175 ▪ 529.177 ▪ 529.1587 ▪ Appendix B

This amendment entitled " Performance and Handling Qualities Requirements for Rotorcraft" provides new and revised airworthiness standards for transport category rotorcraft due to technical advances in design and operational trends in transport category rotorcraft performance and handling qualities. The changes enhance the safety standards for performance and handling qualities to reflect the evolution of rotorcraft capabilities. This amendment harmonizes Transport Canada, U.S. and European airworthiness standards.

Change 529-9 **Published: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the Canadian Aviation Regulations (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends sections 529.1 and 529.602 to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 529 - TRANSPORT CATEGORY ROTORCRAFT

SUBCHAPTER A
GENERAL

529.1 Applicability

(a) This Chapter sets out airworthiness standards for the issue of type certificates and changes to those type certificates, for transport category rotorcraft.

(b) Transport category rotorcraft shall be certificated in accordance with either the Category A or Category B requirements of this Chapter. A multi-engine rotorcraft may be type certificated as both Category A and Category B with appropriate and different operating limitations for each category.

(c) Rotorcraft with a maximum mass (weight) greater than 9000 kg (20,000 lbs.) and 10 or more passenger seats must be type certificated as Category A rotorcraft.
(amended 2009/12/01)

(d) Rotorcraft with a maximum mass (weight) greater than 9000 kg (20,000 lbs.) and nine or less passenger seats may be type certificated as Category B rotorcraft provided the Category A requirements of subchapters C, D, E and F of this chapter are met.
(amended 2009/12/01)

(e) Rotorcraft with a maximum mass (weight) of 9000 kg (20,000 lbs.) or less and 10 or more passenger seats may be type certificated as Category B rotorcraft provided the Category A requirements of sections 529.67(a)(2), 529.87, 529.1517 and of subchapters C, D, E and F of this Chapter are met.
(amended 2009/12/01)

(f) Rotorcraft with a maximum mass (weight) of 9000 kg (20,000 lbs.) or less and nine or less passenger seats may be type certificated as Category B rotorcraft.
(amended 2009/12/01)

(g) Reserved.
(amended 2009/12/01)

***Information Note**: The following text is the corresponding FAR to the Canadian text:*

FAR 529.1(g) "Each person who applies under Part 21 for a certificate or change described in paragraphs (a) through (f) of this section must show compliance with the applicable requirements of this Part."

529.2 Special Retroactive Requirements

For each rotorcraft manufactured after September 16, 1992, each applicant shall

demonstrate that each occupant's seat is equipped with a safety belt and shoulder harness that meets the requirements of (a), (b), and (c) of this section.

(a) each occupant's seat shall have a combined safety belt and shoulder harness with a single-point release. Each pilot's combined safety belt and shoulder harness shall allow each pilot, when seated with safety belt and shoulder harness fastened, to perform all functions necessary for flight operations. There shall be a means to secure belts and harnesses, when not in use, to prevent interference with the operation of the rotorcraft and with rapid egress in an emergency;

(b) each occupant shall be protected from serious head injury by a safety belt plus a shoulder harness that will prevent the head from contacting any injurious object;

(c) the safety belt and shoulder harness shall meet the static and dynamic strength requirements, if applicable, specified by the rotorcraft type certification basis.

(d) for purposes of this section, the date of manufacture is either:

(1) the date the statement of conformity or equivalent inspection acceptance records, reflects that the rotorcraft is complete and meets the type design data approved by the Minister; or

***Information Note**: The following text is the corresponding FAR to the Canadian text:*

FAR 529.2(d)(1) "The date the inspection acceptance records, or equivalent, reflect that the rotorcraft is complete and meets the FAA-Approved Type Design Data; or"

(2) the date that the foreign civil airworthiness authority certifies the rotorcraft is complete and issues an original standard airworthiness certificate, or equivalent, in that country.

***Information Note**: The requirements of section 529.2 shall be met in order to comply with section 605.24(4) of the Canadian Aviation Regulations which requires the installation of safety belts and shoulder harnesses on all rotorcraft manufactured after September 16, 1992.*

529.3 to 529.20 Reserved

SUBCHAPTER B
FLIGHT - GENERAL

529.21 Proof of Compliance

Each requirement of this subchapter shall be met at each appropriate combination of weight and centre of gravity within the range of loading conditions for which certification is requested. This shall be demonstrated:

(a) by tests upon a rotorcraft of the type for which certification is requested, or by calculations based on, and equal in accuracy to, the results of testing; and

(b) by systematic investigation of each required combination of weight and centre of gravity, if compliance cannot be reasonably inferred from combinations investigated.

529.22 to 529.24 Reserved

529.25 Weight Limits

(a) Maximum weight. The maximum weight (the highest weight at which compliance with each applicable requirement of this Chapter is demonstrated) or, at the option of the applicant, the highest weight for each altitude and for each practicably separable operating condition, such as take-off, en route operation, and landing, must be established so that it is not more than:
(amended 2009/05/11)

(1) the highest weight selected by the applicant;

(2) the design maximum weight (the highest weight at which compliance with each applicable structural loading condition of this Chapter is demonstrated);

(3) the highest weight at which compliance with each applicable flight requirement of this Chapter is demonstrated; or

(4) For Category B rotorcraft with 9 or less passenger seats, the maximum weight, altitude and temperature at which the rotorcraft can safely operate near the ground with the maximum wind velocity determined under 529.143(c) and may include other demonstrated wind velocities and azimuths. The operating envelopes must be stated in the Limitations section of the *Rotorcraft Flight Manual*.
(amended 2009/05/11)

(b) Minimum weight. The minimum weight (the lowest weight at which compliance with each applicable requirement of this Chapter is demonstrated) shall be established so that it is not less than:

(1) the lowest weight selected by the applicant;

(2) the design minimum weight (the lowest weight at which compliance with each structural loading condition of this Chapter is demonstrated); or

(3) the lowest weight at which compliance with each applicable flight requirement of this Chapter is demonstrated;

(c) Total weight with jettisonable external load. A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established

under (a) of this section may be established for any rotorcraft-load combination if: (amended 1999/12/01)

(1) the rotorcraft-load combination does not include human external cargo;

(2) structural component approval for external load operations under either section 529.865 or under equivalent operational standards is obtained;

(3) the portion of the total weight that is greater than the maximum weight established under (a) of this section is made up only of the weight of all or part of the jettisonable external load;

(4) structural components of the rotorcraft are demonstrated to comply with the applicable structural requirements of this chapter under the increased loads and stresses caused by the weight increase over that established under (a) of this section; and

(5) operation of the rotorcraft at a total weight greater than the maximum certificated weight established under (a) of this section is limited by appropriate operating limitations under section 529.865(a) and (d) of this chapter.

529.26 Reserved

529.27 Centre of Gravity Limits

The extreme forward and aft centres of gravity and, where critical, the extreme lateral centres of gravity shall be established for each weight established under section 529.25. Such an extreme shall not lie beyond:

(a) the extremes selected by the applicant;

(b) the extremes within which the structure is proven; or

(c) the extremes within which compliance with the applicable flight requirements is demonstrated.

529.28 Reserved

529.29 Empty Weight and Corresponding Centre of Gravity

(a) The empty weight and corresponding centre of gravity shall be determined by weighing the rotorcraft without the crew and payload, but with:

(1) fixed ballast;

(2) unuseable fuel; and

(3) full operating fluids, including:

(i) oil;

(ii) hydraulic fluid; and

(iii) other fluids required for normal operation of rotorcraft systems, except water intended for injection in the engines.

(b) The condition of the rotorcraft at the time of determining empty weight shall be one that is well defined and can be easily repeated, particularly with respect to the weights of fuel, oil, coolant, and installed equipment.

529.30 Reserved

529.31 Removable Ballast

Removable ballast may be used in demonstrating compliance with the flight requirements of this subchapter.

529.32 Reserved

529.33 Main Rotor Speed and Pitch Limits

(a) Main rotor speed limits. A range of main rotor speeds shall be established that:

(1) with power-on, provides adequate margin to accommodate the variations in rotor speed occurring in any appropriate manoeuvre, and is consistent with the kind of governor or synchronizer used; and

(2) with power-off, allows each appropriate autorotative manoeuvre to be performed throughout the ranges of airspeed and weight for which certification is requested.

(b) Normal main rotor high pitch limits (power-on). For rotorcraft, except helicopters required to have a main rotor low speed warning under (e) of this section, it shall be demonstrated with power-on and without exceeding approved engine maximum limitations, that main rotor speeds substantially less than the minimum approved main rotor speed will not occur under any sustained flight condition. This shall be met by:

(1) appropriate setting of the main rotor high pitch stop;

(2) inherent rotorcraft characteristics that make unsafe low main rotor speeds unlikely; or

(3) adequate means to warn the pilot of unsafe main rotor speeds.

(c) Normal main rotor low pitch limit (power-off). It shall be demonstrated, with power-off, that:

(1) the normal main rotor low pitch limit provides sufficient rotor speed, in any autorotative condition, under the most critical combinations of weight and airspeed; and

(2) it is possible to prevent overspeeding of the rotor without exceptional piloting skill.

(d) Emergency high pitch. If the main rotor high pitch stop is set to meet (b)(1) of this section, and if that stop cannot be exceeded inadvertently, additional pitch may be made available for emergency use.

(e) Main rotor low speed warning for helicopters. For each single engine helicopter, and each multi-engined helicopter that does not have an approved device that automatically increases power-on the operating engines when one engine fails, there shall be a main rotor low speed warning which meets the following requirements:

(1) the warning shall be furnished to the pilot in all flight conditions, including power-on and power-off flight, when the speed of a main rotor approaches a value that can jeopardize safe flight;

(2) the warning may be furnished either through the inherent aerodynamic qualities of the helicopter or by a device;

(3) the warning shall be clear and distinct under all conditions, and shall be clearly distinguishable from all other warnings. A visual device that requires the attention of the crew within the cockpit is not acceptable by itself; and

(4) if a warning device is used, the device shall automatically deactivate and reset when the low-speed condition is corrected. If the device has an audible warning, it shall also be equipped with a means for the pilot to manually silence the audible warning before the low-speed condition is corrected.

529.34 to 529.44 Reserved

Performance

529.45 General

(a) The performance prescribed in this subchapter shall be determined:

(1) with normal piloting skill; and

(2) without exceptionally favourable conditions.

(b) Compliance with the performance requirements of this subchapter shall be demonstrated:

(1) for still air at sea level with a standard atmosphere; and

(2) for the approved range of atmospheric variables.

(c) The available power shall correspond to engine power, not exceeding the approved power, less:

(1) installation losses; and

(2) the power absorbed by the accessories and services at the values for which certification is requested and approved.

(d) For reciprocating engine-powered rotorcraft, the performance, as affected by engine power, shall be based on a relative humidity of 80 percent in a standard atmosphere.

(e) For turbine engine-powered rotorcraft, the performance, as affected by engine power, shall be based on a relative humidity of:

(1) 80 percent, at and below standard temperature; and

(2) 34 percent, at and above standard temperature plus 50 degrees F.

Between these two temperatures, the relative humidity shall vary linearly.

(f) For turbine-engine-powered rotorcraft, a means shall be provided to permit the pilot to determine prior to take-off that each engine is capable of developing the power necessary to achieve the applicable rotorcraft performance prescribed in this subchapter.

529.46 to 529.48 Reserved

529.49 Performance at Minimum Operating Speed
(amended 1997/04/07)

(a) For each Category A helicopter, the hovering performance shall be determined over the ranges of weight, altitude, and temperature for which take-off data are scheduled: (amended 1997/04/07)

(1) with not more than take-off power;

(2) with the landing gear extended; and

(3) at a height consistent with the procedure used in establishing the take-off, climb-out, and rejected take-off paths.

(b) For each Category B helicopter, the hovering performance shall be determined over the ranges of weight, altitude, and temperature for which certification is requested, with:
(amended 1997/04/07)

(1) take-off power;

(2) the landing gear extended; and

(3) the helicopter in ground effect at a height consistent with normal take-off procedures.

(c) For each helicopter, the out-of-ground effect hovering performance shall be determined over the ranges of weight, altitude, and temperature for which certification is requested with take-off power.
(amended 1997/04/07)

(d) For rotorcraft other than helicopters, the steady rate of climb at the minimum operating speed shall be determined over the ranges of weight, altitude, and temperature for which certification is requested with:
(amended 1997/04/07)

(1) take-off power; and

(2) the landing gear extended.

529.50 Reserved

529.51 Take-off Data: General

(a) The take-off data required by sections 529.53, 529.55, 529.59, 529.60, 529.61, 529.62, 529.63, and 529.67 shall be determined:
(amended 1997/04/07)

(1) at each weight, altitude, and temperature selected by the applicant; and

(2) with the operating engines within approved operating limitations.

(b) Take-off data shall:

(1) be determined on a smooth, dry, hard surface; and

(2) be corrected to assume a level take-off surface.

(c) No take-off made to determine the data required by this section may require exceptional piloting skill or alertness, or exceptionally favourable conditions.

529.52 Reserved

529.53 Take-off: Category A

The take-off performance shall be determined and scheduled so that, if one engine fails at any time after the start of take-off, the rotorcraft can:
(amended 1997/04/07)

(a) return to, and stop safely on, the take-off area; or
(amended 1997/04/07)

(b) continue the take-off and climb-out, and attain a configuration and airspeed allowing compliance with section 529.67(a)(2).
(amended 1997/04/07)

529.54 Reserved

529.55 Take-off Decision Point (TDP): Category A

(amended 1997/04/07)

(a) The TDP is the first point from which a continued take-off capability if assured under section 529.59 and is the last point in the take-off path from which a rejected take-off is assured within the distance determined under section 529.62.
(amended 1997/04/07)

(b) The TDP shall be established in relation to the take-off path using no more than two parameters; e.g., airspeed and height, to designate the TDP.
(amended 1997/04/07)

(c) Determination of the TDP shall include the pilot recognition time interval following failure of the critical engine.
(amended 1997/04/07)

529.56 to 529.58 Reserved

529.59 Take-off Path: Category A
(amended 1997/04/07)

(a) The take-off path extends from the point of commencement of the take-off procedure to a point at which the rotorcraft is 1,000 feet above the take-off surface and compliance with section 529.67(a)(2) is demonstrated. In addition:
(amended 1997/04/07)

(1) the take-off path shall remain clear of the height-velocity envelope established in accordance with section 529.87;

(2) The rotorcraft shall be flown to the engine failure point; at which point, the critical engine shall be made inoperative and remain inoperative for the rest of the take-off;

(3) after the critical engine is made inoperative, the rotorcraft shall continue to the take-off decision point, and then attain V_{TOSS};

(4) only primary controls may be used while attaining V_{TOSS} and while establishing a positive rate of climb. Secondary controls that are located on the primary controls may be used after a positive rate of climb and V_{TOSS} are established but in no case less than 3 seconds after the critical engine is made inoperative; and

(5) after attaining V_{TOSS} and a positive rate of climb, the landing gear may be retracted.

(b) During the take-off path determination made in accordance with (a) of this section and after attaining V_{TOSS} and a positive rate of climb, the climb shall be continued at a speed as close as practicable to, but not less than, V_{TOSS} until the rotorcraft is 200 feet above the take-off surface. During this interval, the climb performance shall meet or exceed that required by section 529.67 (a)(1).
(amended 1997/04/07)

(c) During the continued take-off, the rotorcraft shall not descend below 15 feet above the take-off surface when the take-off decision point is above 15 feet.
(amended 1997/04/07)

(d) From 200 feet above the take-off surface, the rotorcraft take-off path shall be level or positive until a height 1,000 feet above the take-off surface is attained with not less than the rate of climb required by section 529.67(a)(2). Any secondary or auxiliary control may be used after attaining 200 feet above the take-off surface.
(amended 1997/04/07)

(e) Take-off distance shall be determined in accordance with section 529.61.
(amended 1997/04/07)

529.60 Elevated Heliport Take-off Path: Category A
(amended 1997/04/07)

(a) The elevated heliport take-off path shall extends from the point of commencement of the take-off procedure to a point in the take-off path at which the rotorcraft is 1,000 feet above the take-off surface and compliance with section 529.67 (a)(2) is demonstrated. In addition:
(amended 1997/04/07)

(1) the requirements of section 529.59(a) shall be met;

(2) while attaining V_{TOSS} and a positive rate of climb, the rotorcraft may descend below the level of the take-off surface if, in so doing and when clearing the elevated heliport edge, every part of the rotorcraft clears all obstacles by at least 15 feet;

(3) the vertical magnitude of any descent below the take-off surface shall be determined; and

(4) after attaining V_{TOSS} and a positive rate of climb, the landing gear may be retracted.

(b) The scheduled take-off weight shall be such that the climb requirements of section 529.67 (a)(1) and (a)(2) will be met.
(amended 1997/04/07)

(c) Take-off distance shall be determined in accordance with section 529.61.
(amended 1997/04/07)

529.61 Take-off Distance: Category A
(amended 1997/04/07)

(a) The normal take-off distance shall be the horizontal distance along the take-off path from the start of the take-off to the point at which the rotorcraft attains and remains at least 35 feet above the take-off surface, attains and maintains a speed of at least V_{TOSS}, and establishes a positive rate of climb, assuming the critical engine failure occurs at the engine failure point prior to the take-off decision point.
(amended 1997/04/07)

(b) For elevated heliports, the take-off distance shall be the horizontal distance along the take-off path from the start of the take-off to the point at which the rotorcraft attains and maintains a speed of at least V_{TOSS} and establishes a positive rate of climb, assuming the critical engine failure occurs at the engine failure point prior to the take-off decision point.
(amended 1997/04/07)

529.62 Rejected Take-off: Category A
(amended 1997/04/07)

The rejected take-off distance and procedures for each condition where take-off is approved shall be established with:
(amended 1997/04/07)

(a) the take-off path requirements of sections 529.59 and 529.60 being used up to the TDP where the critical engine failure is recognized and the rotorcraft is landed and brought to a complete stop on the take-off surface;
(amended 1999/12/01)

(b) the remaining engines operating within approved limits;
(amended 1997/04/07)

(c) the landing gear remaining extended throughout the engine rejected take-off; and
(amended 1997/04/07)

(d) the use of only the primary controls until the rotorcraft is on the ground. Secondary controls located on the primary control may not be used until the rotorcraft is on the ground. Means other than wheel brakes may be used to stop the rotorcraft if the means are safe and reliable and consistent results can be expected under normal operating conditions.
(amended 1997/04/07)

529.63 Take-off: Category B

The horizontal distance required to take-off and climb over a 50-foot obstacle shall be established with the most unfavourable centre of gravity. The take-off may be begun in any manner if:

(a) the take-off surface is defined;

(b) adequate safeguards are maintained to ensure proper centre of gravity and control positions; and

(c) a landing can be made safely at any point along the flight path if an engine fails.

529.64 Climb: General
(amended 1997/04/07)

Compliance with the requirements of sections 529.65 and 529.67 shall be demonstrated at each weight, altitude, and temperature within the operational limits established for the rotorcraft and with the most unfavourable centre of gravity for each configuration. Cowl flaps, or other means of controlling the engine-cooling air supply, shall be in the position that provides adequate cooling at the temperatures and altitudes for which certification is requested.
(amended 1997/04/07)

529.65 Climb: All Engines Operating

(a) The steady rate of climb shall be determined:
(amended 1997/04/07)

(1) with maximum continuous power;

(2) with the landing gear retracted; and

(3) at V_y for standard sea level conditions and at speeds selected by the applicant for other conditions.

(b) For each Category B rotorcraft except helicopters, the rate of climb determined under (a) of this section shall provide a steady climb gradient of at least 1:6 under standard sea level conditions.

(c) Removed
(amended 1997/04/07)

529.66 Reserved

529.67 Climb: One Engine Inoperative (OEI)
(amended 1997/04/07)

(a) For Category A rotorcraft, in the critical take-off configuration existing along the take-off path, the following apply:
(amended 1997/04/07)

(1) the steady rate of climb without ground effect, 200 feet above the take-off surface, shall be at least 100 feet per minute for each weight, altitude, and temperature for which take-off data are to be scheduled with:
(amended 1997/04/07)

(i) the critical engine inoperative and the remaining engines within approved operating limitations, except that for rotorcraft for which the use of 30-second/2-minute OEI power is requested, only the 2-minute OEI power may be used in demonstrating compliance with (a)(1)of this section,
(amended 1997/04/07)

(ii) the landing gear extended, and
(amended 1997/04/07)

(iii) the take-off safety speed selected by the applicant; and
(amended 1997/04/07)

(2) the steady rate of climb without ground effect, 1000 feet above the take-off surface, shall be at least 150 feet per minute for each weight, altitude, and temperature for which take-off data are to be scheduled with:
(amended 1997/04/07)

(i) the critical engine inoperative and the remaining engines at maximum

continuous power including continuous OEI power, if approved, or at 30-minute OEI power for rotorcraft for which certification for use of 30-minute OEI power is requested,
(amended 1999/12/01)

(ii) the landing gear retracted, and
(amended 2007/07/16)

(iii) the speed selected by the applicant; and
(amended 2007/07/16)

(3) the steady rate of climb (or descent) in feet per minute, at each altitude and temperature at which the rotorcraft is expected to operate and at any weight within the range of weights for which certification is requested, shall be determined with:
(amended 1997/04/07)

(i) the critical engine inoperative and the remaining engines at maximum continuous power including continuous OEI power, if approved, and at 30-minute OEI power for rotorcraft for which certification for the use of 30-minute OEI power is requested,
(amended 1999/12/01)

(ii) the landing gear retracted, and
(amended 1997/04/07)

(iii) the speed selected by the applicant.
(amended 1997/04/07)

(b) For multi-engine Category B rotorcraft meeting the Category A engine isolation requirements, the steady rate of climb (or descent) shall be determined at the speed for best rate of climb (or minimum rate of descent) at each altitude, temperature, and weight at which the rotorcraft is expected to operate, with the critical engine inoperative and the remaining engines at maximum continuous power including continuous OEI power, if approved, and at 30-minute OEI power for rotorcraft for which certification for the use of 30-minute OEI power is requested.
(amended 1999/12/01)

529.68 to 529.70 Reserved

529.71 Helicopter Angle of Glide: Category B

For each Category B helicopter, except multi-engine helicopters meeting the requirements of section 529.67 (b) and the powerplant installation requirements of Category A, the steady angle of glide shall be determined in autorotation:

(a) at the forward speed for minimum rate of descent as selected by the applicant;

(b) at the forward speed for best glide angle;

(c) at maximum weight; and

(d) at the rotor speed or speeds selected by the applicant.

529.72 to 529.74 Reserved

Information Note: *Section 529.73 - has been replaced by section 529.49 of this Chapter.*
(amended 1997/04/07)

529.75 Landing: General
(amended 1997/04/07)

(a) For each rotorcraft:
(amended 1997/04/07)

(1) the corrected landing data shall be determined for a smooth, dry, hard and level surface;

(2) the approach and landing shall not require exceptional piloting skill or exceptionally favourable conditions; and

(3) the landing shall be made without excessive vertical acceleration or tendency to bounce, nose over, ground loop, porpoise, or water loop.

(b) The landing data required by sections 529.77, 529.79, 529.81, 529.83, and 529.85 shall be determined:
(amended 1997/04/07)

(1) at each weight, altitude, and temperature for which landing data are approved;

(2) with each operating engine within approved operating limitations; and

(3) with the most unfavourable centre of gravity.

529.76 Reserved

529.77 Landing Decision Point (LDP): Category A
(amended 1999/12/01)

(a) The LDP shall be the last point in the approach and landing path from which a balked landing can be accomplished in accordance with section 529.85.
(amended 1999/12/01)

(b) Determination of the LDP shall include the pilot recognition time interval following failure of the critical engine.
(amended 1999/12/01)

529.78 Reserved

529.79 Landing: Category A
(amended 1997/04/07)

(a) For Category A rotorcraft:
(amended 1997/04/07)

(1) the landing performance shall be determined and scheduled so that if the critical engine fails at any point in the approach path, the rotorcraft can either land and stop safely or climb out and attain a rotorcraft configuration and speed allowing compliance with the climb requirements of section 529.67 (a)(2);

(2) the approach and landing paths shall be established with the critical engine inoperative so that the transition between each stage can be made smoothly and safely;

(3) the approach and landing speeds shall be selected by the applicant and shall be appropriate to the type of rotorcraft; and

(4) the approach and landing path shall be established to avoid the critical areas of the height-velocity envelope determined in accordance with section 529.87.

(b) It shall be possible to make a safe landing on a prepared landing surface after complete power failure occurring during normal cruise.
(amended 1997/04/07)

529.80 Reserved

529.81 Landing Distance: Category A
(amended 1999/12/01)

The horizontal distance required to land and come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface shall be determined from the approach and landing paths established in accordance with section 529.79.

529.82 Reserved

529.83 Landing: Category B
(amended 1997/04/07)

(a) For each Category B rotorcraft, the horizontal distance required to land and come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface shall be determined with:
(amended 1997/04/07)

(1) speeds appropriate to the type of rotorcraft and chosen by the applicant to avoid the critical areas of height-velocity envelope established under section 529.87; and

(2) the approach and landing made with power on and within approved limits;

(b) Each multi-engine Category B rotorcraft that meets the powerplant installation requirements for Category A shall meet the requirements of:
(amended 1997/04/07)

(1) sections 529.79 and 529.81; or

(2) (a) of this section;

(c) It shall be possible to make a safe landing on a prepared landing surface if complete power failure occurs during normal cruise.
(amended 1997/04/07)

529.84 Reserved

529.85 Balked Landing: Category A
(amended 1999/12/01)

For Category A rotorcraft, the balked landing path with the critical engine inoperative shall be established so that:
(amended 1999/12/01)

(a) the transition from each stage of the manoeuvre to the next stage can be made smoothly and safely;
(amended 1999/12/01)

(b) from the LDP on the approach path selected by the applicant, a safe climb-out can be made at speeds allowing compliance with the climb requirements of section 529.67 (a)(1) and (a)(2); and
(amended 1999/12/01)

(c) the rotorcraft does not descend below 15 feet above the landing surface. For elevated heliport operations, descent may be below the level of the landing surface provided the deck edge clearance of section 529.60 is maintained and the descent (loss of height) below the landing surface is determined.
(amended 1999/12/01)

529.86 Reserved

529.87 Height-Velocity Envelope
(amended 1997/04/07)

(a) If there is any combination of height and forward velocity (including hover) under which a safe landing cannot be made after failure of the critical engine and with the remaining engines (where applicable) operating within approved limits, a height-velocity envelope shall be established for:
(amended 1997/04/07)

(1) all combinations of pressure altitude and ambient temperature for which take-off

and landing are approved; and

(2) weight from the maximum weight (at sea level) to the highest weight approved for take-off and landing at each altitude. For helicopters, this weight need not exceed the highest weight allowing hovering out-of-ground effect at each altitude.

(b) For single-engine or multi-engine rotorcraft that do not meet the Category A engine isolation requirements, the height-velocity envelope for complete power failure shall be established.
(amended 1997/04/07)

529.88 to 529.140 Reserved

Flight Characteristics

529.141 General

The rotorcraft shall:

(a) except as specifically required in the applicable section, meet the flight characteristics requirements of this subchapter:

(1) at the approved operating altitudes and temperatures;

(2) under any critical loading condition within the range of weights and centres of gravity for which certification is requested;

(3) for power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and

(4) for power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;

(b) be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including:

(1) sudden failure of one engine, for multi-engine rotorcraft meeting transport Category A engine isolation requirements;

(2) sudden, complete power failure, for other rotorcraft;

(3) sudden, complete control system failures specified in section 529.695 of this Chapter; and

(c) have any additional characteristics required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Chapter.

529.142 Reserved

529.143 Controllability and Manoeuvrability

(a) The rotorcraft must be safely controllable and manoeuvrable:
(amended 2009/05/11)

(1) during steady flight; and

(2) during any manoeuvre appropriate to the type, including:

(i) take-off,

(ii) climb,

(iii) level flight,

(iv) turning flight,

(v) autorotations, and
(amended 2009/05/11)

(vi) landing (power-on and power-off).

(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with:
(amended 2009/05/11)

(1) critical weight;

(2) critical centre of gravity;

(3) critical rotor r.p.m; and

(4) power-off (except for helicopters demonstrating compliance with paragraph (f) of this section) and power-on.
(amended 2009/05/11)

(c) Wind velocities from zero to at least 17 knots, from all azimuths, must be established in which the rotorcraft can be operated without loss of control on or near the ground in any manoeuvre appropriate to the type (such as crosswind take-offs, sideward flight, and rearward flight), with:
(amended 2009/05/11)

(1) critical weight;

(2) critical centre of gravity;

(3) critical rotor r.p.m; and

(4) altitude, from standard sea level conditions to the maximum take-off and landing altitude capability of the rotorcraft.
(amended 2009/05/11)

(d) Wind velocities from zero to at least 17 knots, from all azimuths, must be established in which the rotorcraft can be operated without loss of control out-of-ground effect, with:
(amended 2009/05/11)

(1) Weight selected by the applicant;
(amended 2009/05/11)

(2) Critical centre of gravity;
(amended 2009/05/11)

(3) Rotor r.p.m. selected by the applicant; and
(amended 2009/05/11)

(4) Altitude, from standard sea level conditions to the maximum take-off and landing altitude capability of the rotorcraft.
(amended 2009/05/11)

(e) The rotorcraft, after one (1) failure of one engine, in the case of multi-engine rotorcraft that meet transport Category A engine isolation requirements, or two (2)

complete power failures in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failures occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than: (amended 2009/05/11)

(i) for the cruise condition, one second, or normal pilot reaction time (whichever is greater); and

(ii) for any other condition, normal pilot reaction time.

(f) For helicopters for which a V_{NE} (power-off) is established under section 529.1505 (c), compliance must be demonstrated with the following requirements with critical weight, critical centre of gravity, and critical rotor r.p.m.: (amended 2009/05/11)

(1) the helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill after the last operating engine is made inoperative at power-on V_{NE}; and (amended 2009/05/11)

(2) at a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power-off . (amended 2009/05/11)

529.144 to 529.150 Reserved

529.151 Flight Controls

(a) Longitudinal, lateral, directional, and collective controls shall not exhibit excessive breakout force, friction, or preload.

(b) Control system forces and free play shall not inhibit a smooth, direct rotorcraft response to control system input.

529.152 to 529.160 Reserved

529.161 Trim Control

The trim control:

(a) shall trim any steady longitudinal, lateral, and collective control forces to zero in level flight at any appropriate speed; and

(b) shall not introduce any undesirable discontinuities in control force gradients.

529.162 to 529.170 Reserved

529.171 Stability: General

The rotorcraft shall be able to be flown, without undue pilot fatigue or strain, in any normal manoeuvre for a period of time as long as that expected in normal operation. At least three landings and take-offs shall be made during this demonstration.

529.172 Reserved

529.173 Static Longitudinal Stability

(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain an airspeed less than the trim speed, and a forward movement of the control is necessary to obtain an airspeed more than the trim speed.

(amended 2009/05/11)

(b) Throughout the full range of altitude for which certification is requested, with the throttle and collective pitch held constant during the manoeuvres specified in section 529.175 (a) through (d), the slope of the control position versus airspeed curve must be positive. However, in limited flight conditions or modes of operation determined by the Minister to be acceptable, the slope of the control position versus airspeed curve may be neutral or negative if the rotorcraft possesses flight characteristics that allow the pilot to maintain airspeed within ± 5 knots of the desired trim airspeed without exceptional piloting skill or alertness.
(amended 2009/05/11)

529.174 Reserved

529.175 Demonstration of Static Longitudinal Stability

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from V_Y -10 kt to V_Y +10 kt with:
(amended 2009/05/11)

(1) critical weight;

(2) critical centre of gravity;

(3) maximum continuous power;

(4) the landing gear retracted; and

(5) the rotorcraft trimmed at V_Y.

(b) Cruise. Static longitudinal stability must be shown in the cruise condition at speeds from 0.8 V_{NE} -10 kt to 0.8 V_{NE} +10 kt or, if V_H is less than 0.8 V_{NE}, from V_H -10 kt to V_H +10 kt, with:
(amended 2009/05/11)

(1) critical weight;

(2) critical centre of gravity;

(3) power for level flight at 0.8 V_{NE} or V_H, whichever is less;
(amended 2009/05/11)

(4) the landing gear retracted; and

(5) the rotorcraft trimmed at 0.8 V_{NE} or V_H, whichever is less.
(amended 2009/05/11)

(c) V_{NE}. Static longitudinal stability must be shown at airspeeds from V_{NE} -20 kt to V_{NE} with:
(amended 2009/05/11)

(1) critical weight;
(amended 2009/05/11)

(2) critical centre of gravity;
(amended 2009/05/11)

(3) power required for level flight at V_{NE} -10 kt or maximum continuous power, whichever is less;
(amended 2009/05/11)

(4) the landing gear retracted; and
(amended 2009/05/11)

(5) the rotorcraft trimmed at V_{NE} -10 kt.
(amended 2009/05/11)

(d) Autorotation. Static longitudinal stability must be shown in autorotation at:

(1) Airspeeds from the minimum rate of descent airspeed -10 kt to the minimum rate of descent airspeed +10 kt, with:
(amended 2009/05/11)

(i) Critical weight;

(ii) Critical centre of gravity;

(iii) The landing gear extended; and
(amended 2009/05/11)

(iv) The rotorcraft trimmed at the minimum rate of descent airspeed.

(2) Airspeeds from the best angle-of-glide airspeed -10 kt to the best angle-of-glide airspeed +10 kt, with:
(amended 2009/05/11)

(i) Critical weight;
(amended 2009/05/11)

(ii) Critical centre of gravity;
(amended 2009/05/11)

(iii) The landing gear retracted; and
(amended 2009/05/11)

(iv) The rotorcraft trimmed at the best angle-of-glide airspeed.
(amended 2009/05/11)

529.176 Reserved

529.177 Static Directional Stability

(a) The directional controls must operate in such a manner that the sense and direction of motion of the rotorcraft following control displacement are in the direction of the pedal motion with throttle and collective controls held constant at the trim conditions specified in 529.175(a), (b), (c), and (d). Sideslip angles must increase with steadily increasing directional control deflection for sideslip angles up to the lesser of:
(amended 2009/05/11)

(1) ±25 degrees from trim at a speed of 15 knots less than the speed for minimum rate of descent varying linearly to ±10 degrees from trim at V_{NE};
(amended 2009/05/11)

(2) The steady-state sideslip angles established by 529.351;
(amended 2009/05/11)

(3) A sideslip angle selected by the applicant, which corresponds to a side-force of at least 0.1g; or
(amended 2009/05/11)

(4) The sideslip angle attained by maximum directional control input.

(amended 2009/05/11)

(b) Sufficient cues must accompany the sideslip to alert the pilot when approaching sideslip limits.

(amended 2009/05/11)

(c) During the manoeuvre specified in paragraph (a) of this section, the sideslip angle versus directional control position curve may have a negative slope within a small range of angles around trim, provided the desired heading can be maintained without exceptional piloting skill or alertness.

(amended 2009/05/11)

529.178 to 529.180 Reserved

529.181 Dynamic Stability: Category A Rotorcraft

Any short-period oscillation occurring at any speed from V_Y to V_{NE} shall be positively damped with the primary flight controls free and in a fixed position.

529.182 to 529.230 Reserved

Ground and Water Handling Characteristics

529.231 General

The rotorcraft shall have satisfactory ground and water handling characteristics, including freedom from uncontrollable tendencies in any condition expected in operation.

529.232 to 529.234 Reserved

529.235 Taxiing Condition

The rotorcraft shall be designed to withstand the loads that would occur when the rotorcraft is taxied over the roughest ground that may reasonably be expected in normal operation.

529.236 to 529.238 Reserved

529.239 Spray Characteristics

If certification for water operation is requested, no spray characteristics during taxiing, take-off, or landing shall obscure the vision of the pilot or damage the rotors, propellers, or other parts of the rotorcraft.

529.240 Reserved

529.241 Ground Resonance

The rotorcraft shall have no dangerous tendency to oscillate on the ground with the rotor turning.

529.242 to 529.250 Reserved

Miscellaneous Flight Requirements

529.251 Vibration

Each part of the rotorcraft shall be free from excessive vibration under each appropriate speed and power condition.

529.252 to 529.300 Reserved

SUBCHAPTER C
STRENGTH REQUIREMENTS - GENERAL

529.301 Loads

(a) Strength requirements are specified in terms of limit loads (the maximum loads to be expected in service) and ultimate loads (limit loads multiplied by prescribed factors of safety). Unless otherwise provided, prescribed loads are limit loads.

(b) Unless otherwise provided, the specified air, ground, and water loads shall be placed in equilibrium with inertia forces, considering each item of mass in the rotorcraft. These loads shall be distributed to closely approximate or conservatively represent actual conditions.

(c) If deflections under load would significantly change the distribution of external or internal loads, this redistribution shall be taken into account.

529.302 Reserved

529.303 Factor of Safety

Unless otherwise provided, a factor of safety of 1.5 shall be used. This factor applies to external and inertia loads unless its application to the resulting internal stresses is more conservative.

529.304 Reserved

529.305 Strength and Deformation

(a) The structure shall be able to support limit loads without detrimental or permanent deformation. At any load up to limit loads, the deformation may not interfere with safe operation.

(b) The structure shall be able to support ultimate loads without failure. This shall be demonstrated by:

(1) applying ultimate loads to the structure in a static test for at least 3 seconds; or

(2) dynamic tests simulating actual load application.

529.306 Reserved

529.307 Proof of Structure

(a) Compliance with the strength and deformation requirements of this subchapter shall be demonstrated for each critical loading condition accounting for the environment to which the structure will be exposed in operation. Structural analysis (static or fatigue) may be used only if the structure conforms to those for which experience has demonstrated this method to be reliable. In other cases, substantiating load tests shall

be made.

(b) Proof of compliance with the strength requirements of this subchapter shall include:

(1) dynamic and endurance tests of rotors, rotor drives, and rotor controls;

(2) limit load tests of the control system, including control surfaces;

(3) operation tests of the control system;

(4) flight stress measurement tests;

(5) landing gear drop tests; and

(6) any additional tests required for new or unusual design features.

529.308 Reserved

529.309 Design Limitations

The following values and limitations shall be established to demonstrate compliance with the structural requirements of this subchapter:

(a) the design maximum and design minimum weights;

(b) the main rotor r.p.m. ranges, power-on and power-off;

(c) the maximum forward speeds for each main rotor r.p.m. within the ranges determined under (b) of this section;

(d) the maximum rearward and sideward flight speeds;

(e) the centre of gravity limits corresponding to the limitations determined under (b), (c), and (d) of this section;

(f) the rotational speed ratios between each powerplant and each connected rotating component; and

(g) the positive and negative limit manoeuvring load factors.

529.310 to 529.320 Reserved

Flight Loads

529.321 General

(a) The flight load factor shall be assumed to act normal to the longitudinal axis of the rotorcraft, and to be equal in magnitude and opposite in direction to the rotorcraft inertia load factor at the centre of gravity.

(b) Compliance with the flight load requirements of this subchapter: shall be demonstrated:

(1) at each weight from the design minimum weight to the design maximum weight; and

(2) with any practical distribution of disposable load within the operating limitations in the *Rotorcraft Flight Manual.*

529.322 to 529.336 Reserved

529.337 Limit Manoeuvring Load Factor

The rotorcraft shall be designed for:

(a) a limit manoeuvring load factor ranging from a positive limit of 3.5 to a negative limit of -1.0; or

(b) any positive limit manoeuvring load factor not less than 2.0 and any negative limit manoeuvring load factor of not less than -0.5, for which:

(1) the probability of being exceeded is demonstrated by analysis and flight tests to be extremely remote; and

(2) the selected values are appropriate to each weight condition between the design maximum and design minimum weights.

529.338 Reserved

529.339 Resultant Limit Manoeuvring Loads

The loads resulting from the application of limit manoeuvring load factors are assumed to act at the centre of each rotor hub and at each auxiliary lifting surface, and to act in directions and with distributions of load among the rotors and auxiliary lifting surfaces, so as to represent each critical manoeuvring condition, including power-on and power-off flight with the maximum design rotor tip speed ratio. The rotor tip speed ratio is the ratio of the rotorcraft flight velocity component in the plane of the rotor disc to the rotational tip speed of the rotor blades, and is expressed as follows:

$$\mu = \frac{V \cos\alpha}{\Omega R}$$

Where:

V = The airspeed along the flight path (f.p.s.);

a = The angle between the projection, in the plane of symmetry, of the axis of no feathering and a line perpendicular to the flight path (radians, positive when axis is pointing aft);

Ω =The angular velocity of rotor (radians per second); and

R = The rotor radius (ft.).

529.340 Reserved

529.341 Gust Loads

Each rotorcraft shall be designed to withstand, at each critical airspeed including hovering, the loads resulting from vertical and horizontal gusts of 30 feet per second.

529.342 to 529.350 Reserved

529.351 Yawing Conditions

(a) Each rotorcraft shall be designed for the loads resulting from the manoeuvres specified in (b) and (c) of this section, with:

(1) unbalanced aerodynamic moments about the centre of gravity which the aircraft reacts to in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces; and

(2) maximum main rotor speed.

(b) To produce the load required in (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from zero up to 0.6 V_{NE}:

(1) displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in section 529.397 (a);
(amended 1998/10/29)

(2) attain a resulting sideslip angles or 90°, whichever is less; and

(3) return the directional control suddenly to neutral.

(c) To produce the load required in (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from 0.6 V_{NE} up to V_{NE} or V_H, whichever is less:

(1) displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in section 529.397 (a);
(amended 1998/10/29)

(2) attain a resulting sideslip angle or 15°, whichever is less, at the lesser speed of V_{NE} or V_H;

(3) vary the sideslip angles of (b)(2) and (c)(2) of this section directly with speed; and

(4) return the directional control suddenly to neutral.

529.352 to 529.360 Reserved

529.361 Engine Torque

The limit engine torque may not be less than the following:

(a) for turbine engines, the highest of:

(1) the mean torque for maximum continuous power multiplied by 1.25;

(2) the torque required by section 529.923;

(3) the torque required by section 529.927; or

(4) the torque imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming);

(b) for reciprocating engines, the mean torque for maximum continuous power multiplied by:

(1) 1.33, for engines with five or more cylinders; and

(2) two, three, and four, for engines with four, three, and two cylinders, respectively.

529.362 to 529.390 Reserved

Control Surface and System Loads

529.391 General

Each auxiliary rotor, each fixed or movable stabilizing or control surface, and each system operating any flight control shall meet the requirements of sections 529.395 through 529.399, 529.411, and 529.427.
(amended 1998/10/29)

529.392 to 529.394 Reserved

529.395 Control System

(a) The reaction to the loads prescribed in section 529.397 shall be provided by:

(1) the control stops only;

(2) the control locks only;

(3) the irreversible mechanism only (with the mechanism locked and with the control surface in the critical positions for the effective parts of the system within its limit of motion);

(4) the attachment of the control system to the rotor blade pitch control horn only (with the control in the critical positions for the affected parts of the system within the limits of its motion); and

(5) the attachment of the control system to the control surface horn (with the control

in the critical positions for the affected parts of the system within the limits of its motion).

(b) Each primary control system, including its supporting structure, shall be designed as follows:

(1) the system shall withstand loads resulting from the limit pilot forces prescribed in section 529.397;

(2) notwithstanding (b)(3) of this section, when power-operated actuator controls or power boost controls are used, the system shall also withstand the loads resulting from the limit pilot forces prescribed in section 529.397 in conjunction with the forces output of each normally energized power device, including any single power boost or actuator system failure;

(3) if the system design or the normal operating loads are such that a part of the system cannot react to the limit pilot forces prescribed in section 529.397, that part of the system shall be designed to withstand the maximum loads that can be obtained in normal operation. The minimum design loads shall, in any case, provide a rugged system for service use, including consideration of fatigue, jamming, ground gusts, control inertia, and friction loads. In the absence of a rational analysis, the design loads resulting from 0.60 of the specified limit pilot forces are acceptable minimum design loads; and

(4) if operational loads may be exceeded through jamming, ground gusts, control inertia, or friction, the system shall withstand the limit pilot forces specified in section 529.397, without yielding.

529.396 Reserved

529.397 Limit Pilot Forces and Torques

(a) Except as provided in (b) of this section, the limit pilot forces are as follows:

(1) for foot controls, 130 pounds; and

(2) for stick controls, 100 pounds fore and aft, and 67 pounds laterally.

(b) For flap, tab, stabilizer, rotor brake, and landing gear operating controls, the following apply (R = radius in inches):

(1) crank, wheel, and lever controls, (1 + R)/3 x 50 pounds, but not less than 50 pounds nor more than 100 pounds for hand operated controls or 130 pounds for foot operated controls, applied at any angle within 20 degrees of the plane of motion of the control; and

(2) twist controls, 80R inch-pounds.
(amended 2001/10/24)

529.398 Reserved

529.399 Dual Control System

Each dual primary flight control system shall be able to withstand the loads that result when pilot forces not less than 0.75 times those obtained under section 529.395 are applied:

(a) in opposition; and

(b) in the same direction.

529.400 Reserved

529.401 Removed

529.402 Reserved

529.403 Removed

529.404 to 529.410 Reserved

529.411 Ground Clearance: Tail Rotor Guard

(a) It shall be impossible for the tail rotor to contact the landing surface during a normal landing.

(b) If a tail rotor guard is required to demonstrate compliance with (a) of this section:

(1) suitable design loads shall be established for the guard; and

(2) the guard and its supporting structure shall be designed to withstand those loads.

529.412 Reserved

529.413 Removed

529.414 to 529.426 Reserved

529.427 Unsymmetrical Loads

(a) Horizontal tail surfaces and their supporting structure shall be designed for unsymmetrical loads arising from yawing and rotor wake effects in combination with the prescribed flight conditions.

(b) To meet the design criteria of (a) of this section, in the absence of more rational data, both of the following shall be met:

(1) one hundred percent of the maximum loading from the symmetrical flight conditions acts on the surface on one side of the plane of symmetry, and no loading acts on the other side; and

(2) fifty percent of the maximum loading from the symmetrical flight conditions acts on the surface on each side of the plane of symmetry but in opposite directions.

(c) For empennage arrangements where the horizontal tail surfaces are supported by the vertical tail surfaces, the vertical tail surfaces and supporting structure shall be designed for the combined vertical and horizontal surface loads resulting from each prescribed flight condition, considered separately. The flight conditions shall be selected so that the maximum design loads are obtained on each surface. In the absence of more rational data, the unsymmetrical horizontal tail surface loading distributions described in this section must be assumed.

529.428 to 529.470 Reserved

Ground Loads

529.471 General

(a) Loads and equilibrium. For limit ground loads:

(1) the limit ground loads obtained in the landing conditions in this Chapter shall be considered to be external loads that would occur in the rotorcraft structure if it were acting as a rigid body; and

(2) in each specified landing condition, the external loads shall be placed in equilibrium with linear and angular inertia loads in a rational or conservative manner.

(b) Critical centres of gravity. The critical centres of gravity within the range for which certification is requested shall be selected so that the maximum design loads are obtained in each landing gear element.

529.472 Reserved

529.473 Ground Loading Conditions and Assumptions

(a) For specified landing conditions, a design maximum weight shall be used that is not less than the maximum weight. A rotor lift may be assumed to act through the centre of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight.

(b) Unless otherwise prescribed, for each specified landing condition, the rotorcraft shall be designed for a limit load factor of not less than the limit inertia load factor substantiated under section 529.725.

(c) Triggering or actuating devices for additional or supplementary energy absorption may not fail under loads established in the tests prescribed in sections 529.725 and 529.727, but the factor of safety prescribed in section 529.303 need not be used.

529.474 Reserved

529.475 Tires and Shock Absorbers

Unless otherwise prescribed, for each specified landing condition, the tires shall be assumed to be in their static position and the shock absorbers to be in their most critical position.

529.476 Reserved

529.477 Landing Gear Arrangement

Sections 529.235, 529.479 through 529.485, and 529.493 apply to landing gear with two wheels aft, and one or more wheels forward, of the centre of gravity.

529.478 Reserved

529.479 Level Landing Conditions

(a) Attitudes. Under each of the loading conditions prescribed in (b) of this section, the rotorcraft is assumed to be in each of the following level landing attitudes:

(1) an attitude in which each wheel contacts the ground simultaneously; and

(2) an attitude in which the aft wheels contact the ground with the forward wheels just clear of the ground.

(b) Loading conditions. The rotorcraft shall be designed for the following landing loading conditions:

(1) vertical loads applied under section 529.471;

(2) the loads resulting from a combination of the loads applied under (b)(1) of this section with drag loads at each wheel of not less than 25 percent of the vertical load at that wheel;

(3) the vertical load at the instant of peak drag load combined with a drag component simulating the forces required to accelerate the wheel rolling assembly up to the specified ground speed, with:

(i) the ground speed for determination of the spin-up loads being at least 75 percent of the optimum forward flight speed for minimum rate of descent in autorotation, and

(ii) the loading conditions of (b) (3) of this section applied to the landing gear and its attaching structure only;

(4) if there are two wheels forward, a distribution of the loads applied to those wheels under (b)(1) and (b)(2) of this section in a ratio of 40:60.

(c) Pitching moments. Pitching moments are assumed to be resisted by:

(1) in the case of the attitude in (a)(1) of this section, the forward landing gear; and

(2) in the case of the attitude in (a)(2) of this section, the angular inertia forces.

529.480 Reserved

529.481 Tail-down Landing Conditions

(a) The rotorcraft is assumed to be in the maximum nose-up attitude allowing ground clearance by each part of the rotorcraft.

(b) In this attitude, ground loads are assumed to act perpendicular to the ground.

529.482 Reserved

529.483 One-wheel Landing Conditions

For the one-wheel landing condition, the rotorcraft is assumed to be in the level attitude and to contact the ground on one aft wheel. In this attitude:

(a) the vertical load shall be the same as that obtained on that side under section 529.479(b)(1); and

(b) the unbalanced external loads shall be reacted by rotorcraft inertia.

529.484 Reserved

529.485 Lateral Drift Landing Conditions

(a) The rotorcraft is assumed to be in the level landing attitude, with:

(1) side loads combined with one half of the maximum ground reactions obtained in the level landing conditions of section 529.479 (b)(1); and

(2) the loads obtained under (a)(1) of this section applied:

(i) at the ground contact point, or

(ii) for full-swivelling gear, at the centre of the axle.

(b) The rotorcraft shall be designed to withstand, at ground contact:

(1) when only the aft wheels contact the ground, side loads of 0.8 times the vertical reaction acting inward on one side and 0.6 times the vertical reaction acting outward on the other side, all combined with the vertical loads specified in (a) of this section; and

(2) when the wheels contact the ground simultaneously:

(i) for the aft wheels, the side loads specified in (b)(1) of this section, and

(ii) for the forward wheels, a side load of 0.8 times the vertical reaction combined with the vertical load specified in (a) of this section.

529.486 to 529.492 Reserved

529.493 Braked Roll Conditions

Under braked roll conditions with the shock absorbers in their static positions:

(a) the limit vertical load shall be based on a load factor of at least:

(1) 1.33, for the attitude specified in section 529.479 (a)(1); and

(2) 1.0, for the attitude specified in section 529.479 (a)(2);

(b) the structure shall be designed to withstand, at the ground contact point of each wheel with brakes, a drag load of at least the lesser of:

(1) the vertical load multiplied by a coefficient of friction of 0.8; and

(2) the maximum value based on limiting brake torque.

529.494 to 529.496 Reserved

529.497 Ground Loading Conditions: Landing Gear with Tail Wheels

(a) General. Rotorcraft with landing gear with two wheels forward and one wheel aft of the centre of gravity shall be designed for loading conditions as prescribed in this section.

(b) Level landing attitude with only the forward wheels contacting the ground. In this attitude:

(1) the vertical loads shall be applied under sections 529.471 through 529.475;

(2) the vertical load at each axle shall be combined with a drag load at that axle of not less than 25 percent of that vertical load; and

(3) unbalanced pitching moments are assumed to be resisted by angular inertia forces.

(c) Level landing attitude with all wheels contacting the ground simultaneously. In this attitude, the rotorcraft shall be designed for landing loading conditions as prescribed in (b) of this section.

(d) Maximum nose-up attitude with only the rear wheel contacting the ground. The attitude for this condition shall be the maximum nose-up attitude expected in normal operation, including autorotative landings. In this attitude:

(1) the appropriate ground loads specified in (b)(1) and (b)(2) of this section shall be determined and applied, using a rational method to account for the moment arm between the rear wheel ground reaction and the rotorcraft centre of gravity; or

(2) the probability of landing with initial contact on the rear wheel shall be demonstrated to be extremely remote.

(e) Level landing attitude with only one forward wheel contacting the ground. In this attitude, the rotorcraft shall be designed for ground loads as specified in (b)(1) and (b)(3) of this section.

(f) Side loads in the level landing attitude. In the attitudes specified in (b) and (c) of this section, the following apply:

(1) the side loads shall be combined at each wheel with one-half of the maximum vertical ground reactions obtained for that wheel under (b) and (c) of this section. In this condition, the side loads shall be:

(i) for the forward wheels, 0.8 times the vertical reaction (on one side) acting inward, and 0.6 times the vertical reaction (on the other side) acting outward, and

(ii) for the rear wheel, 0.8 times the vertical reaction;

(2) the loads specified in (f)(1) of this section shall be applied:

(i) at the ground contact point with the wheel in the trailing position (for non-full swivelling landing gear or for full swivelling landing gear with a lock, steering device, or shimmy damper to keep the wheel in the trailing position), or

(ii) at the centre of the axle (for full swivelling landing gear without a lock, steering device, or shimmy damper).

(g) Braked roll conditions in the level landing attitude. In the attitudes specified in (b) and (c) of this section, and with the shock absorbers in their static positions, the rotorcraft shall be designed for braked roll loads as follows:

(1) the limit vertical load shall be based on a limit vertical load factor of not less than:

(i) 1.0, for the attitude specified in (b) of this section, and

(ii) 1.33, for the attitude specified in (c) of this section;

(2) For each wheel with brakes, a drag load shall be applied, at the ground contact point, of not less than the lesser of:

(i) 0.8 times the vertical load, and

(ii) the maximum based on limiting brake torque.

(h) Rear wheel turning loads in the static ground attitude. In the static ground attitude, and with the shock absorbers and tires in their static positions, the rotorcraft shall be designed for rear wheel turning loads as follows:

(1) a vertical ground reaction equal to the static load on the rear wheel shall be combined with an equal side load;

(2) the load specified in (h)(1) of this section shall be applied to the rear landing gear:

(i) through the axle, if there is a swivel (the rear wheel being assumed to be

swivelled 90° to the longitudinal axis of the rotorcraft), or

(ii) at the ground contact point if there is a lock, steering device or shimmy damper (the rear wheel being assumed to be in the trailing position).

(i) Taxiing condition. The rotorcraft and its landing gear shall be designed for the loads that would occur when the rotorcraft is taxied over the roughest ground that may reasonably be expected in normal operation.

529.498 to 529.500 Reserved

529.501 Ground Loading Conditions: Landing Gear with Skids

(a) General. Rotorcraft with landing gear with skids shall be designed for the loading conditions specified in this section. In demonstrating compliance with this section, the following apply:

(1) the design maximum weight, centre of gravity, and load factor shall be determined under sections 529.471 through 529.475;

(2) structural yielding of elastic spring members under limit loads is acceptable;

(3) design ultimate loads for elastic spring members need not exceed those obtained in a drop test of the gear with:

(i) a drop height of 1.5 times that specified in section 529.725, and

(ii) an assumed rotor lift of not more than 1.5 times that used in the limit drop tests prescribed in section 529.725;

(4) compliance with (b) through (e) of this section shall be demonstrated with:

(i) the gear in its most critically deflected position for the landing condition being considered, and

(ii) the ground reactions rationally distributed along the bottom of the skid tube.

(b) Vertical reactions in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the vertical reactions shall be applied as prescribed in (a) of this section.

(c) Drag reactions in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) the vertical reactions shall be combined with horizontal drag reactions of 50 percent of the vertical reaction applied at the ground; and

(2) the resultant ground loads shall equal the vertical load specified in (b) of this section.

(d) Sideloads in the level landing attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) the vertical ground reaction shall be:

(i) equal to the vertical loads obtained in the condition specified in (b) of this section, and

(ii) divided equally among the skids;

(2) the vertical ground reactions shall be combined with a horizontal sideload of 25 percent of their value;

(3) the total sideload shall be applied equally between skids and along the length of the skids;

(4) the unbalanced moments are assumed to be resisted by angular inertia;

(5) the skid gear shall be investigated for:

(i) inward acting sideloads, and

(ii) outward acting sideloads.

(e) One-skid landing loads in the level attitude. In the level attitude, and with the rotorcraft contacting the ground along the bottom of one skid only, the following apply:

(1) the vertical load on the ground contact side shall be the same as that obtained on that side in the condition specified in (b) of this section; and

(2) the unbalanced moments are assumed to be resisted by angular inertia.

(f) Special conditions. In addition to the conditions specified in (b) and (c) of this section, the rotorcraft shall be designed for the following ground reactions:

(1) a ground reaction load acting up and aft at an angle of 45° to the longitudinal axis of the rotorcraft. This load shall be:

(i) equal to 1.33 times the maximum weight,

(ii) distributed symmetrically among the skids,

(iii) concentrated at the forward end of the straight part of the skid tube, and

(iv) applied only to the forward end of the skid tube and its attachment to the rotorcraft;

(2) with the rotorcraft in the level landing attitude, a vertical ground reaction load equal to one-half of the vertical load determined under (b) of this section. This load shall be:

(i) applied only to the skid tube and its attachment to the rotorcraft, and

(ii) distributed equally over 33.3 percent of the length between the skid tube attachments and centrally located midway between the skid tube attachments.

529.502 to 529.504 Reserved

529.505 Ski Landing Conditions

If certification for ski operation is requested, the rotorcraft, with skis, shall be designed to withstand the following loading conditions (where P is the maximum static weight on each ski with the rotorcraft at design maximum weight, and n is the limit load factor determined under section 529.473(b):

(a) up-load conditions in which:

(1) a vertical load of P*n* and a horizontal load of P*n*/4 are simultaneously applied at the pedestal bearings; and

(2) a vertical load of 1.33 P is applied at the pedestal bearings;

(b) a side load condition in which a side load of 0.35 P*n* is applied at the pedestal bearings in a horizontal plane perpendicular to the centreline of the rotorcraft; and

(c) a torque-load condition in which a torque load of 1.33 P (in foot-pounds) is applied to the ski about the vertical axis through the centreline of the pedestal bearings.

529.506 to 529.510 Reserved

529.511 Ground Load: Unsymmetrical Loads on Multiple-Wheel Units

(a) In dual-wheel gear units, 60 percent of the total ground reaction for the gear unit shall be applied to one wheel and 40 percent to the other.

(b) To provide for the case of one deflated tire, 60 percent of the specified load for the gear unit shall be applied to either wheel except that the vertical ground reaction may not be less than the full static value.

(c) In determining the total load on a gear unit, the transverse shift in the load centroid, due to unsymmetrical load distribution on the wheels, may be neglected.

529.512 to 529.518 Reserved

Water Loads

529.519 Hull Type Rotorcraft: Water-based and Amphibian

(a) General. For hull type rotorcraft, the structure shall be designed to withstand the water loading set forth in (b), (c), and (d) of this section considering the most severe wave heights and profiles for which approval is desired. The loads for the landing conditions of (b) and (c) of this section shall be developed and distributed along and among the hull and auxiliary floats, if used, in a rational and conservative manner, assuming a rotor lift not exceeding two-thirds of the rotorcraft weight to act throughout

the landing impact.

(b) Vertical landing conditions. The rotorcraft shall initially contact the most critical wave surface at zero forward speed in likely pitch and roll attitudes which result in critical design loadings. The vertical descent velocity may not be less than 6.5 f.p.s. relative to the mean water surface.

(c) Forward speed landing conditions. The rotorcraft shall contact the most critical wave at forward velocities from 0 up to 30 knots in likely pitch, roll, and yaw attitudes and with a vertical descent velocity of not less than 6.5 f.p.s. relative to the mean water surface. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine-out landing.

(d) Auxiliary float immersion condition. In addition to the loads from the landing conditions, the auxiliary float and its support and attaching structure in the hull, shall be designed for the load developed by a fully immersed float unless it can be demonstrated that full immersion of the float is unlikely, in which case the highest likely float buoyancy load shall be applied that considers loading of the float immersed to create restoring moments compensating for upsetting moments caused by side wind, asymmetrical rotorcraft loading, water wave action, and rotorcraft inertia.

529.520 Reserved

529.521 Float Landing Conditions

If certification for float operation (including float amphibian operation) is requested, the rotorcraft, with floats, shall be designed to withstand the following loading conditions (where the limit load factor is determined under section 529.473(b) or assumed to be equal to that determined for wheel landing gear):

(a) up-load conditions in which:

(1) a load is applied so that, with the rotorcraft in the static level attitude, the resultant water reaction passes vertically through the centre of gravity; and

(2) the vertical load prescribed in (a)(1) of this section is applied simultaneously with an aft component of 0.25 times the vertical component;

(b) a side load condition in which:

(1) a vertical load of 0.75 times the total vertical load specified in (a)(1) of this section is divided equally among the floats; and

(2) for each float, the load share determined under (b)(1) of this section combined with a total side load of 0.25 times the total vertical load specified in (b)(1) of this section, is applied to that float only.

529.522 to 529.546 Reserved

Main Component Requirements

529.547 Main and Tail Rotor Structure
(amended 1997/04/07)

(a) A rotor is an assembly of rotating components, which includes the rotor, hub, blades, blade dampers, the pitch control mechanisms, and all other parts that rotate with the assembly.
(amended 1997/04/07)

(b) Each rotor assembly shall be designed as prescribed in this section and shall function safely for the critical flight load and operating conditions. A design assessment shall be performed, including a detailed failure analysis to identify all failures that will prevent continued safe flight or safe landing, and shall identify the means to minimize the likelihood of their occurrence.
(amended 1997/04/07)

(c) The rotor structure shall be designed to withstand the following loads prescribed in sections 529.337 through 529.341, and 529.351:
(amended 1997/04/07)

(1) critical flight loads;

(2) limit loads occurring under normal conditions of autorotation.

(d) The rotor structure shall be designed to withstand loads simulating:
(amended 1997/04/07)

(1) for the rotor blades, hubs, and flapping hinges, the impact force of each blade against its stop during ground operation; and

(2) any other critical condition expected in normal operation.

(e) The rotor structure shall be designed to withstand the limit torque at any rotational speed, including zero. In addition:
(amended 1997/04/07)

(1) the limit torque need not be greater than the torque defined by a torque limiting device (where provided), and may not be less than the greater of:

(i) the maximum torque likely to be transmitted to the rotor structure, in either direction, by the rotor drive or by sudden application of the rotor brake, and

(ii) for the main rotor, the limit engine torque specified in section 529.361; and
(amended 1997/04/07)

(2) the limit torque shall be equally and rationally distributed to the rotor blades.

529.548 Reserved

529.549 Fuselage and Rotor Pylon Structures

(a) Each fuselage and rotor pylon structure shall be designed to withstand:

(1) the critical loads prescribed in sections 529.337 through 529.341, and 529.351;

(2) the applicable ground loads prescribed in sections 529.235, 529.471 through 529.485, 529.493, 529.497, 529.505, and 529.521; and

(3) the loads prescribed in section 529.547 (d)(1) and (e)(1)(i).

(b) Auxiliary rotor thrust, the torque reaction of each rotor drive system, and the balancing air and inertia loads occurring under accelerated flight conditions, shall be considered.

(c) Each engine mount and adjacent fuselage structure shall be designed to withstand the loads occurring under accelerated flight and landing conditions, including engine torque.

(d) Removed

(e) If approval for the use of 2 1/2-minute OEI power is requested, each engine mount and adjacent structure shall be designed to withstand the loads resulting from a limit torque equal to 1.25 times the mean torque for 2 1/2-minute OEI power combined with 1 g flight loads.

529.550 Reserved

529.551 Auxiliary Lifting Surfaces

Each auxiliary lifting surface shall be designed to withstand:

(a) the critical flight loads in sections 529.337 through 529.341, and 529.351;

(b) the applicable ground loads in sections 529.235, 529.471 through 529.485, 529.493, 529.505, and 529.521; and

(c) any other critical condition expected in normal operation.

529.552 to 529.660 Reserved

Emergency Landing Conditions

529.561 General

(a) The rotorcraft, although it may be damaged in emergency landing conditions on land or water, shall be designed as prescribed in this section to protect the occupants under those conditions.

(b) The structure shall be designed to give each occupant every reasonable chance of escaping serious injury in a crash landing when:

(1) proper use is made of seats, belts, and other safety design provisions;

(2) the wheels are retracted (where applicable); and

(3) each occupant and each item of mass inside the cabin that could injure an occupant is restrained when subjected to the following ultimate inertial load factors relative to the surrounding structure:

(i) upward - 4g,

(ii) forward - 16g,

(iii) sideward - 8g,

(iv) downward - 20g after the intended displacement of the seat device, and

(v) rearward - 1.5g.
(amended 1997/04/07)

(c) The supporting structure shall be designed to restrain under any ultimate inertial load factor up to those specified in (c) of this section, any item of mass above and/or behind the crew and passenger compartment that could injure an occupant if it came loose in an emergency landing. Items of mass to be considered include, but are not limited to, rotors, transmission, and engines. The items of mass shall be restrained for the following ultimate inertial load factors:

(1) upward - 1.5g;

(2) forward - 12g;
(amended 1997/04/07)

(3) sideward - 6g;
(amended 1997/04/07)

(4) downward -12g; and
(amended 1997/04/07)

(5) rearward - 1.5g.
(amended 1997/04/07)

(d) Any fuselage structure in the area of internal fuel tanks below the passenger floor level shall be designed to resist the following ultimate inertial factors and loads, and to protect the fuel tanks from rupture, if rupture is likely when those loads are applied to that area:

(1) upward - 1.5g;

(2) forward - 4.0g;

(3) sideward - 2.0g; and

(4) downward - 4.0g.

529.562 Emergency Landing Dynamic Conditions

(a) The rotorcraft, although it may be damaged in a crash landing, shall be designed to reasonably protect each occupant when:

(1) the occupant properly uses the seats, safety belts, and shoulder harnesses provided in the design; and

(2) the occupant is exposed to loads equivalent to those resulting from the conditions prescribed in this section.

(b) Each seat type design or other seating device approved for crew or passenger occupancy during take-off and landing shall successfully complete dynamic tests or be demonstrated by rational analysis based on dynamic tests of a similar type seat in accordance with the following criteria. The tests shall be conducted with an occupant, simulated by a 170-pound anthropomorphic test dummy (ATD), as defined by 49 CFR 572, Subpart B, or its equivalent, sitting in the normal upright position.

(1) a change in downward velocity of not less than 30 feet per second when the seat or other seating device is oriented in its nominal position with respect to the rotorcraft's reference system, the rotorcraft's longitudinal axis is canted upward 60° with respect to the impact velocity vector, and the rotorcraft's lateral axis is perpendicular to a vertical plane containing the impact velocity vector and the rotorcraft's longitudinal axis. Peak floor deceleration shall occur in not more than 0.031 seconds after impact and shall reach a minimum of 30g's.

(2) a change in forward velocity of not less than 42 feet per second when the seat or other seating device is oriented in its nominal position with respect to the rotorcraft's reference system, the rotorcraft's longitudinal axis is yawed 10° either right or left of the impact velocity vector (whichever would cause the greatest load on the shoulder harness), the rotorcraft's lateral axis is contained in a horizontal plane containing the impact velocity vector, and the rotorcraft's vertical axis is perpendicular to a horizontal plane containing the impact velocity vector. Peak floor deceleration shall occur in not more than 0.071 seconds after impact and shall reach a minimum of 18.4g's.

(3) where floor rails or floor or [sidewall attachment] devices are used to attach the seating devices to the airframe structure for the conditions of this section, the rails or devices shall be misaligned with respect to each other by at least 10° vertically (i.e., pitch out of parallel) and by at least a 10° lateral roll, with the directions optional, to account for possible floor warp.
(amended 1998/10/29)

(c) Compliance with the following shall be demonstrated:

(1) the seating device system shall remain intact although it may experience separation intended as part of its design;

(2) the attachment between the seating device and the airframe structure shall remain intact, although the structure may have exceeded its limit load;

(3) the ATD's shoulder harness strap or straps shall remain on or in the immediate vicinity of the ATD's shoulder during the impact;

(4) the safety belt must remain on the ATD's pelvis during the impact;

(5) the ATD's head either does not contact any portion of the crew or passenger compartment, or if contact is made, the head impact does not exceed a head injury criteria (HIC) of 1,000 as determined by this equation.

$$HIC = (t_2 - t_1)\left[\frac{1}{(t_2 - t_1)}\int_{t_1}^{t_2} a(t)dt\right]^{2.5}$$

Where:

a(t) is the resultant acceleration at the centre of gravity of the head form expressed as a multiple of g (the acceleration of gravity) and

$t_2 - t_1$ is the time duration, in seconds, of major head impact, not to exceed 0.05 seconds; and

(6) loads in individual shoulder harness straps shall not exceed 1,750 pounds. If dual straps are used for retaining the upper torso, the total harness strap loads shall not exceed 2,000 pounds;

(7) the maximum compressive load measured between the pelvis and the lumbar column of the ATD shall not exceed 1,500 pounds.

(d) An alternate approach that achieves an equivalent or greater level of occupant protection, as required by this section, shall be substantiated on a rational basis.

529.563 Structural ditching provisions

If certification with ditching provisions is requested, structural strength for ditching shall meet the requirements of this section and section 529.801 (e).

(a) Forward speed landing conditions. The rotorcraft shall initially contact the most critical wave for reasonably probable water conditions at forward velocities from zero up to 30 knots in likely pitch, roll, and yaw attitudes. The rotorcraft limit vertical descent velocity may not be less than 5 feet per second relative to the mean water surface. Rotor lift may be used to act through the centre of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine-out touchdown;

(b) Auxiliary or emergency float conditions:

(1) Floats fixed or deployed before initial water contact. In addition to the landing

loads in (a) of this section, each auxiliary or emergency float, or its support and attaching structure in the airframe or fuselage, shall be designed for the load developed by a fully immersed float unless it can be demonstrated that full immersion is unlikely. If full immersion is unlikely, the highest likely float buoyancy load shall be applied. The highest likely buoyancy load shall include consideration of a partially immersed float creating restoring moments to compensate the upsetting moments caused by side wind. Unsymmetrical rotorcraft loading, water wave action, rotorcraft inertia, and probable structural damage and leakage considered under section 529.801(d). Maximum roll and pitch angles determined from compliance with 529.801(d) may be used, if significant, to determine the extent of immersion of each float. If the floats are deployed in flight, appropriate air loads derived from the flight limitations with the floats deployed shall be used in substantiation of the floats and their attachment to the rotorcraft. For this purpose, the design airspeed for limit load is the float deployed airspeed operating limit multiplied by 1.11; and

(2) Floats deployed after initial water contact. Each float shall be designed for full or partial immersion prescribed in (b)(1) of this section. In addition, each float shall be designed for combined vertical and drag loads using a relative limit speed of 20 knots between the rotorcraft and the water. The vertical load may not be less than the highest likely buoyancy load determined under b)(1) of this section.

529.564 to 529.570 Reserved

Fatigue Evaluation

529.571 Fatigue Evaluation of Flight Structure

(a) General. An evaluation of the strength of principal elements, detail design points, and fabrication techniques shall demonstrate that catastrophic failure due to fatigue, considering the effects of environment intrinsic/discrete flaws, or accidental damage will be avoided. Parts to be evaluated include, but are not limited to, rotors, rotor drive systems between the engines and rotor hubs, controls, fuselage, fixed and movable control surfaces, engine and transmission mountings, landing gear, and their related primary attachments. In addition, the following apply:

(1) each evaluation required by this section shall include:

(i) the identification of principal structural elements, the failure of which could result in catastrophic failure of the rotorcraft,

(ii) in-flight measurement in determining the loads or stresses for items in (a)(1)(i) of this section in all critical conditions throughout the range of limitations in section 529.309 (including altitude effects), except that manoeuvring load factors need not exceed the maximum values expected in operations, and

(iii) loading spectra as severe as those expected in operation based on loads or stresses determined under (a)(1)(ii) of this section, including external load operations, if applicable, and other high frequency power cycle operations;

(2) based on the evaluations required by this section, inspections, replacement times, combinations thereof, or other procedures shall be established as necessary to avoid catastrophic failure. These inspections, replacement times, combinations thereof, or other procedures shall be included in the airworthiness limitations section of the Instructions for Continued Airworthiness required by section 529.1529 and section A529.4 of Appendix A of this chapter.

(b) Fatigue tolerance evaluation (including tolerance to flaws). The structure shall be demonstrated by analysis supported by test evidence and, if available, service experience to be of fatigue tolerant design. The fatigue tolerance evaluation shall include the requirements of either (b) (1), (2), or (3) of this section, or a combination thereof, and also shall include a determination of the probable locations and modes of damage caused by fatigue, considering environmental effects, intrinsic/discrete flaws, or accidental damage. Compliance with the flaw tolerance requirements of (b) (1), or (2) of this section is required unless the applicant establishes that these fatigue flaw tolerant methods for a particular structure cannot be achieved within the limitations of geometry, inspectability, or good design practice. Under these circumstances, the safe-life evaluation of (b)(3) of this section is required.:

(1) Flaw tolerant safe-life evaluation. It shall be demonstrated that the structure, with flaws present, is able to withstand repeated loads of variable magnitude without detectable flaw growth for the following time intervals:

(i) life of the rotorcraft, or

(ii) within a replacement time furnished under section A529.4 of appendix A to this chapter;

(2) Fail-safe (residual strength after flaw growth) evaluation. It shall be demonstrated that the structure remaining after a partial failure is able to withstand design limit loads without failure within an inspection period furnished under section A529.4 of appendix A to this chapter. Limit loads are defined in section 529.301(a):

(i) the residual strength evaluation shall demonstrate that the remaining structure after flaw growth is able to withstand design limit loads without failure within its operational life,

(ii) inspection intervals and methods shall be established as necessary to ensure that failure are detected prior to residual strength conditions being reached, and

(iii) if significant changes in structural stiffness or geometry, or both, follow from a structural failure or partial failure, the effect on flaw tolerance shall be further investigated;

(3) Safe-life evaluation. It shall be demonstrated that the structure is able to withstand repeated loads of variable magnitude without detectable cracks for the following time intervals:

(i) life of the rotorcraft, or

(ii) within a replacement time furnished under section A529.4 of Appendix A to this chapter.

529.572 to 529.600 Reserved

SUBCHAPTER D
DESIGN AND CONSTRUCTION - GENERAL

529.601 Design

(a) The rotorcraft shall have no design features or details that experience has demonstrated to be hazardous or unreliable.

(b) The suitability of each questionable design detail and part shall be established by tests.

529.602 Critical Parts

(amended 2003/06/23)

(a) Critical part. A critical part is a part, the failure of which could have a catastrophic effect upon the rotorcraft and for which critical characteristics have been identified which, in turn, must be controlled to ensure the required level of integrity.
(amended 2009/12/01)

(b) If the type design includes critical parts, a critical parts list shall be established. Procedures are established to define the critical design characteristics, identify processes that affect those characteristics and identify the design change and process change controls necessary for showing compliance with the quality assurance requirements of Part V, Subparts 21, 61, 71 and Part VI, Subpart 5 of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

529.603 Materials

The suitability and durability of materials used for parts, the failure of which could adversely affect safety, shall:

(a) be established on the basis of experience or tests;

(b) meet approved specifications that ensure their having the strength and other properties assumed in the design data; and

(c) take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

529.604 Reserved

529.605 Fabrication Methods

(a) The methods of fabrication used shall produce consistently sound structures. If a fabrication process (such as gluing, spot welding or heat-treating) requires close control to reach this objective, the process shall be performed according to an approved process specification.

(b) Each new aircraft fabrication method shall be substantiated by a test program.

529.606 Reserved

529.607 Fasteners

(a) Each removable bolt, screw, nut, pin or other fastener whose loss could jeopardize

the safe operation of the rotorcraft shall incorporate two separate locking devices. The fastener and its locking devices may not be adversely affected by the environmental conditions associated with the particular installation.

(b) No self-locking nut shall be used on any bolt subject to rotation in operation unless a non-friction locking device is used in addition to the self-locking device.

529.608 Reserved

529.609 Protection of Structure

Each part of the structure shall:

(a) be suitably protected against deterioration or loss of strength in service due to any cause, including:

(1) weathering,

(2) corrosion, and

(3) abrasion; and

(b) have provisions for ventilation and drainage where necessary to prevent the accumulation of corrosive, flammable or noxious fluids.

529.610 Lightning and Static Electricity Protection
(amended 1997/04/07)

(a) The rotorcraft structure shall be protected against catastrophic effects from lightning.
(amended 1997/04/07)

(b) For metallic components, compliance with (a) of this section may be demonstrated by:

(1) electrically bonding the components properly to the airframe; or

(2) designing the components so that a strike will not endanger the rotorcraft.

(c) For non-metallic components, compliance with (a) of this section may be demonstrated by:

(1) designing the components to minimize the effect of a strike; or

(2) incorporating acceptable means of diverting the resulting electrical current to not endanger the rotorcraft.

(d) The electric bonding and protection against lightning and static electricity shall:
(amended 1997/04/07)

(1) minimize the accumulation of electrostatic charge;

(2) minimize the risk of electric shock to crew, passengers, and service and maintenance personnel using normal precautions;

(3) provide an electrical return path, under both normal and fault conditions, on rotorcraft having grounded electrical systems; and

(4) reduce to an acceptable level the effects of lightning and static electricity on the functioning of essential electrical and electronic equipment.

529.611 Inspection Provisions

There shall be means to allow close examination of each part that requires:

(a) recurring inspection;

(b) adjustment for proper alignment and functioning; or

(c) lubrication.

529.612 Reserved

529.613 Material Strength Properties and Design Values

(a) Material strength properties shall be based on enough tests of material meeting specifications to establish design values on a statistical basis.

(b) Design values shall be chosen to minimize the probability of structural failure due to material variability. Except as provided in (d) and (e) of this section, compliance with (a) of this section shall be demonstrated by selecting design values that assure material strength with the following probability:

(1) where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component, 99 percent probability with 95 percent confidence; and

(2) for redundant structures, those in which the failure of individual elements would result in applied loads being safely distributed to other load-carrying members, 90 percent probability with 95 percent confidence.

(c) The strength, detail design, and fabrication of the structure shall minimize the probability of disastrous fatigue failure, particularly at points of stress concentration.

(d) Design values may be those contained in the following publications (available from the Naval Publications and Forms Centre, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120):

(1) MIL-HDBK-5, "Metallic Materials and Elements for Flight Vehicle Structure";

(2) MIL-HDBK-17, "Plastics for Flight Vehicles";

(3) ANC-18, "Design of Wood Aircraft Structures";

(4) MIL-HDBK-23, "Composite Construction for Flight Vehicles".

(e) Other design values may be used if a selection of the material is made in which a specimen of each individual item is tested before use and it is determined that the actual strength properties of that particular item will equal or exceed those used in design.

529.614 to 529.618 Reserved

529.619 Special Factors

(a) The special factors prescribed in sections 529.621 through 529.625 apply to each part of the structure whose strength is:

(1) uncertain;

(2) likely to deteriorate in service before normal replacement; or

(3) subject to appreciable variability due to:

(i) uncertainties in manufacturing processes, or

(ii) uncertainties in inspection methods.

(b) For each part of the rotorcraft to which sections 529.621 through 529.625 apply, the factor of safety prescribed in section 529.303 shall be multiplied by a special factor equal to:

(1) the applicable special factors prescribed in sections 529.621 through 529.625; or

(2) any other factor great enough to ensure that the probability of the part being understrength because of the uncertainties specified in (a) of this section is extremely remote.

529.620 Reserved

529.621 Casting Factors

(a) General. The factors, tests and inspections specified in (b) and (c) of this section shall be applied in addition to those necessary to establish foundry quality control. The inspections shall meet approved specifications. The dispositions (c) and (d) of this section apply to structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads.

(b) Bearing stresses and surfaces. The casting factors specified in (c) and (d) of this section:

(1) need not exceed 1.25 with respect to bearing stresses regardless of the method of inspection used; and

(2) need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

(c) Critical castings. For each casting whose failure would preclude continued safe flight and landing of the rotorcraft or result in serious injury to any occupant, the following apply:

(1) each critical casting shall:

(i) have a casting factor of not less than 1.25, and

(ii) receive 100 percent inspection by visual, radiographic and magnetic particle (for ferromagnetic materials) or penetrant (for non-ferromagnetic materials) inspection methods or approved equivalent inspection methods;
(amended 1998/10/29)

(2) for each critical casting with a casting factor less than 1.50, three sample castings shall be static tested and demonstrated to meet:

(i) the strength requirements of section 529.305 at an ultimate load corresponding to a casting factor of 1.25, and

(ii) the deformation requirements of section 529.305 at a load of 1.15 times the limit load.

(d) Non-critical castings. For each casting other than those specified in (c) of this section, the following apply:

(1) except as provided in (d)(2) and (d)(3) of this section, the casting factors and corresponding inspections shall meet the following table:

Casting Factor	Inspection
2.0 or greater	100% visual
Less than 2.0, greater than 1.5	100% visual, and magnetic particle (ferromagnetic materials), penetrant (non-ferromagnetic materials), or approved equivalent inspection methods.
1.25 through 1.50	100% visual, and magnetic particle (ferromagnetic materials), penetrant (non-ferromagnetic materials), and radiographic or approved equivalent inspection methods.

(2) the percentage of castings inspected by non-visual methods may be reduced below that specified in (d)(1) of this section when an approved quality control procedure is established;

(3) for castings procured to a specification that guarantees the mechanical properties of the material in the casting and provides for demonstration of these properties by test of coupons cut from the castings on a sampling basis:

(i) a casting factor of 1.0 may be used, and

(ii) the castings shall be inspected as provided in (d)(1) of this section for casting factors of "1.25 through 1.50" and tested under (c)(2) of this section.

529.622 Reserved

529.623 Bearing Factors

(a) Except as provided in (b) of this section, each part that has clearance (free fit), and that is subject to pounding or vibration, shall have a bearing factor large enough to provide for the effects of normal relative motion.

(b) No bearing factor is needed to be used on a part for which any larger special factor is prescribed.

529.624 Reserved

529.625 Fitting Factors

For each fitting (part or terminal used to join one structural member to another) the following apply:

(a) for each fitting whose strength is not proven by limit and ultimate load tests in which actual stress conditions are simulated in the fitting and surrounding structures, a fitting factor of at least 1.15 shall be applied to each part of:

(1) the fitting,

(2) the means of attachment, and

(3) the bearing on the joined members;

(b) no fitting factor is needed to be used:

(1) for joints made under approved practices and based on comprehensive test data (such as continuous joints in metal plating, welded joints, and scarf joints in wood); and

(2) with respect to any bearing surface for which a larger special factor is used.

(c) for each integral fitting, the part shall be treated as a fitting up to the point at which the section properties become typical of the member;

(d) each seat, berth, litter, safety belt and harness attachment to the structure shall be demonstrated by analysis, tests, or both, to be able to withstand the inertia forces prescribed in section 529.561 (b)(3) multiplied by a factor of 1.33.
(amended 1998/11/23)

529.626 to 529.628 Reserved

529.629 Flutter and Divergence
(amended 1997/04/07)

Each aerodynamic surface of the rotorcraft shall be free from flutter and divergence under each appropriate speed and power condition.
(amended 1997/04/07)

529.630 Reserved

Rotors

529.631 Bird Strike
(amended 1997/04/07)

The rotorcraft shall be designed to ensure capability of continued safe flight and landing (for Category A) or safe landing (for Category B) after impact with a 2.2-lbs. (1.0 kg) bird when the velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is equal to V_{NE} or V_H (whichever is the lesser) at altitudes up to 8,000 feet. Compliance shall be demonstrated by tests or by analysis based on tests carried out on sufficiently representative structures of similar design.
(amended 1997/04/07)

529.632 to 529.652 Reserved

529.653 Pressure Venting and Drainage of Rotor Blades

(a) For each rotor blade:

(1) there shall be means for venting the internal pressure of the blade;

(2) drainage holes shall be provided for the blade; and

(3) the blade shall be designed to prevent water from becoming trapped in it.

(b) The conditions prescribed under (a) (1) and (2) of this section do not apply to sealed rotor blades capable of withstanding the maximum pressure differentials expected in service.

529.654 to 529.658 Reserved

529.659 Mass Balance

(a) The rotor and blades shall be mass balanced as necessary to:

(1) prevent excessive vibration; and

(2) prevent flutter at any speed up to the maximum forward speed.

(b) The structural integrity of the mass balance installation shall be substantiated.

529.660 Reserved

529.661 Rotor Blade Clearance

There shall be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure during any operating condition.

529.662 Reserved

529.663 Ground Resonance Prevention Means

(a) The reliability of the means for preventing ground resonance shall be demonstrated either by analysis and tests, or reliable service experience, or by demonstrating through analysis or tests that malfunction or failure of a single means will not cause ground resonance.

(b) The probable range of variations, during service, of the damping action of the ground resonance prevention means shall be established and shall be investigated during the test required by section 529.241.

529.664 to 529.670 Reserved

Control Systems

529.671 General

(a) Each control and control system shall operate with the ease, smoothness and positiveness appropriate to its function.

(b) Each element of each flight control system shall be designed, or distinctively and permanently marked, to minimize the probability of any incorrect assembly that could result in the malfunction of the system.

(c) A means shall be provided to allow full control movement of all primary flight controls prior to flight, or a means shall be provided that will allow the pilot to determine that full control authority is available prior to flight.

529.672 Stability Augmentation, Automatic, and Power operated Systems

If the functioning of stability augmentation or other automatic or power-operated systems is necessary to demonstrate compliance with the flight characteristics requirements of this Chapter, the system shall comply with section 529.671 of this Chapter and the following:

(a) a warning which is clearly distinguishable to the pilot under expected flight conditions without requiring the pilot's attention shall be provided for any failure in the stability augmentation system or in any other automatic or power-operated system which could result in an unsafe condition if the pilot is unaware of the failure. Warning systems shall not activate the control systems;

(b) the design of the stability augmentation system or of any other automatic or power-operated system shall allow initial counteraction of failures without requiring exceptional pilot skill or strength, by overriding the failure by moving the flight controls in the normal sense, and by deactivating the failed system;

(c) it shall be demonstrated that after any single failure of the stability augmentation system or any other automatic or power-operated system:

(1) the rotorcraft is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations;

(2) the controllability and manoeuvrability requirements of this Chapter are met within a practical operational flight envelope (for example, speed, altitude, normal acceleration and rotorcraft configurations) which is described in the *Rotorcraft Flight Manual*; and

(3) the trim and stability characteristics are not impaired below a level needed to allow continued safe flight and landing.

529.673 Primary Flight Controls

Primary flight controls are those used by the pilot for immediate control of pitch, roll, yaw and vertical motion of the rotorcraft.

529.674 Interconnected controls.

Each primary flight control system shall provide for safe flight and landing and operate independently after a malfunction, failure or jam of any auxiliary interconnected control.

529.675 Stops

(a) Each control system shall have stops that positively limit the range of motion of the pilot's controls.

(b) Each stop shall be located in the system so that the range of travel of its control is not appreciably affected by:

(1) wear;

(2) slackness; or

(3) take-up adjustments.

(c) Each stop shall be able to withstand the loads corresponding to the design conditions for the system.

(d) For each main rotor blade:

(1) stops that are appropriate to the blade design shall be provided to limit travel of the blade about its hinge points; and

(2) there shall be means to keep the blade from hitting the droop stops during any operation other than starting and stopping the rotor.

529.676 to 529.678 Reserved

529.679 Control System Locks

If there is a device to lock the control system with the rotorcraft on the ground or water, there shall be means to:

(a) automatically disengage the lock when the pilot operates the controls in a normal manner, or limit the operation of the rotorcraft so as to give unmistakable warning to the pilot before take-off; and

(b) prevent the lock from engaging in flight.

529.680 Reserved

529.681 Limit Load Static Tests

(a) Compliance with the limit load requirements of this Chapter shall be demonstrated by tests in which:

(1) the direction of the test loads produces the most severe loading in the control system; and

(2) each fitting, pulley and bracket used in attaching the system to the main structure is included.

(b) Compliance shall be demonstrated (by analyses or individual load tests) with the special factor requirements for control system joints subject to angular motion.

529.682 Reserved

529.683 Operation Tests

It shall be demonstrated by operation tests that, when the controls are operated form the pilot compartment with the control system loaded to correspond with loads specified for the system, the system is free from:

(a) jamming;

(b) excessive friction; and

(c) excessive deflection.

529.684 Reserved

529.685 Control System Details

(a) Each detail of each control system shall be designed to prevent jamming, chafing and interference from cargo, passengers, loose objects, or the freezing of moisture.

(b) There shall be means in the cockpit to prevent the entry of foreign objects into places where they would jam the system.

(c) There shall be means to prevent the slapping of cables or tubes against other parts.

(d) Cable systems shall be designed as follows:

(1) cables, cable fittings, turnbuckles, splices and pulleys shall be of an acceptable kind;

(2) the design of cable systems shall prevent any hazardous change in cable tension throughout the range of travel under any operating conditions and temperature variations;

(3) no cable smaller than one eight inch diameter shall be used in any primary control system;

(4) pulley kinds and sizes shall correspond to the cables with which they are used. The pulley-cable combinations and strength values specified in MIL-HDBK-5 shall be used unless they are inapplicable;

(5) pulleys shall have close fitting guards to prevent the cables from being displaced or fouled;

(6) pulleys shall lie close enough to the plane passing through the cable to prevent the cable from rubbing against the pulley flange;

(7) no fairlead shall cause a change in cable direction of more than 3°;

(8) no clevis pin, subject to load or motion and retained only by cotter pins, shall be used in the control system;

(9) turnbuckles, attached to parts having angular motion, shall be installed to prevent binding throughout the range of travel; and

(10) there shall be means for visual inspection at each fairlead, pulley, terminal, and turnbuckle.

(e) Control system joints subject to angular motion shall incorporate the following special factors with respect to the ultimate bearing strength of the softest material used as a bearing:

(1) 3.33 for push-pull systems other than ball and roller bearing systems;

(2) 2.0 for cable systems.

(f) For control system joints, the manufacturer's static, non-Brinell rating of ball and roller bearings shall not be exceeded.

529.686 Reserved

529.687 Spring Devices

(a) Each control system spring device whose failure could cause flutter or other unsafe characteristics shall be reliable.

(b) Compliance with (a) of this section shall be demonstrated by tests simulating service conditions.

529.688 to 529.690 Reserved

529.691 Autorotation Control Mechanism

Each main rotor blade pitch control mechanism shall allow rapid entry into autorotation after power failure.

529.692 to 529.694 Reserved

529.695 Power Boost and Power-operated Control System

(a) If a power boost or power-operated control system is used, an alternate system shall be immediately available that allows continued safe flight and landing in the event of:

(1) any single failure in the power portion of the system; or

(2) the failure of all engines.

(b) Each alternate system may be a duplicate power portion or a manually operated mechanical system. The power portion includes the power source (such as hydraulic pumps), and such items as valves, lines and actuators.

(c) The failure of mechanical parts (such as piston rods and links), and the jamming of power cylinders, shall be considered unless they are extremely improbable.

529.696 to 529.722 Reserved

Landing Gear

529.723 Shock Absorption Tests

The landing inertia load factor and the reserve energy absorption capacity of the landing gear shall be substantiated by the tests prescribed in sections 529.725 and 529.727 respectively. These tests shall be conducted on the complete rotorcraft or on units consisting of wheel, tire and shock absorber in their proper relation.

529.724 Reserved

529.725 Limit Drop Test

The limit drop test shall be conducted as follows:

(a) the drop height shall be at least 8 inches (203 mm);

(b) if considered, the rotor lift specified in section 529.473 (a) shall be introduced into the drop test by appropriate energy absorbing devices or by the use of an effective mass;

(c) each landing gear unit shall be tested in the attitude simulating the landing condition that is most critical from the standpoint of the energy to be absorbed by it;

(d) when an effective mass is used in demonstrating compliance with (b) of this section, the following formula may be used instead of more rational computations:

$$W_e = W \frac{h+(1-L)d}{h+d} \quad \text{and} \quad n = n_j \frac{W_e}{W} + L$$

where:

W_e = the effective weight to be used in the drop test (lbs);

$W = W_M$ for main gear units (lbs), equal to the static reaction on the particular unit with the rotorcraft in the most critical attitude. A rational method may be used in computing a main gear static reaction, taking into consideration the moment arm between the main wheel reaction and the rotorcraft centre of gravity;

$W = W_N$ for nose gear units (lbs), equal to the vertical component of the static reaction that would exist at the nose wheel, assuming that the mass of the rotorcraft acts at the centre of gravity and exerts a force of 1.0g downward and 0.25g forward;

$W = W_T$ for tailwheel units (lbs), equal to whichever of the following is critical:

(1) the static weight on the tailwheel with the rotorcraft resting on all wheels; or

(2) the vertical component of the ground reaction that would occur at the tailwheel assuming that the mass of the rotorcraft acts at the centre of gravity and exerts a force of 1g downward with the rotorcraft in the maximum nose-up attitude considered in the nose-up landing conditions;

h = specified free drop height (inches);

L = ratio of assumed rotor lift to the rotorcraft weight;

d = deflection under impact of the tire (at the proper inflation pressure) plus the vertical component of the axle travel (inches) relative to the drop mass;

n = limit inertia load factor;

n_j = the load factor developed during impact on the mass used in the drop test (i.e., the acceleration *dv/dt* in *g*'s recorded in the drop test plus 1.0).

529.726 Reserved

529.727 Reserve Energy Absorption Drop Test

The reserve energy absorption drop test shall be conducted as follows:

(a) the drop height shall be 1.5 times that specified in section 529.725 (a);

(b) rotor lift, where considered in a manner similar to that prescribed in section 529.725 (b), shall not exceed 1.5 times the lift allowed under section 529.725 (b); and

(c) the landing gear shall withstand this test without collapsing. Collapse of the landing gear occurs when a member of the nose, tail or main gear will not support the rotorcraft in the proper attitude or allows the rotorcraft structure, other than landing gear and external accessories, to impact the landing surface.

529.728 Reserved

529.729 Retracting Mechanism

For rotorcraft with retractable landing gear, the following apply:

(a) Loads. The landing gear, retracting mechanism, wheel well doors and supporting structure shall be designed for:

(1) the loads occurring in any manoeuvring condition with the gear retracted;

(2) the combined friction, inertia and air loads occurring during retraction and extension at any airspeed up to the design maximum landing gear operating speed; and

(3) the flight loads, including those in yawed flight, occurring with the gear extended at any airspeed up to the design maximum landing gear extended speed;

(b) Landing gear lock. A positive means shall be provided to keep the gear extended;

(c) Emergency operation. When other than manual power is used to operate the gear, emergency means shall be provided for extending the gear in the event of:

(1) any reasonably probable failure in the normal retraction system; or

(2) the failure of any single source of hydraulic, electric or equivalent energy;

(d) Operation tests. The proper functioning of the retracting mechanism shall be demonstrated by operation tests;

(e) Position indicator. There shall be means to indicate to the pilot when the gear is secured in the extreme positions;

(f) Control. The location and operation of the retraction control shall meet the requirements of sections 529.777 and 529.779;

(g) Landing gear warning. An aural or equally effective landing gear warning device shall be provided that functions continuously when the rotorcraft is in a normal landing mode and the landing gear is not fully extended and locked. A manual shut-off capability shall be provided for the warning device and the warning system shall automatically reset when the rotorcraft is no longer in the landing mode.

529.730 Reserved

529.731 Wheels

(a) Each landing gear wheel shall be approved.

(b) The maximum static load rating of each wheel shall not be less than the corresponding static ground reaction with:

(1) maximum weight; and

(2) critical centre of gravity.

(c) The maximum limit load rating of each wheel shall equal or exceed the maximum radial limit load determined under the applicable ground load requirements of this Chapter.

529.732 Reserved

529.733 Tires

Each landing gear wheel shall have a tire:

(a) that is a proper fit on the rim of the wheel;

(b) of a rating that is not exceeded under:

(1) the design maximum weight,

(2) a load on each main wheel tire equal to the static ground reaction corresponding to the critical centre of gravity, and

(3) a load on nose wheel tires (to be compared with the dynamic rating established for those tires) equal to the reaction obtained at the nose wheel, assuming that the mass of the rotorcraft acts at the most critical centre of gravity and exerts a force of 1.0 g. downward and 0.25 g. forward, the reactions being distributed to the nose and main wheels according to the principles of statics with the drag reaction at the ground applied only at wheels with brakes; and

(c) each tire installed on a retractable landing gear system shall, at the maximum size of the tire type expected in service, have a clearance to surrounding structure and systems that is adequate to prevent contact between the tire and any part of the structure or systems.

529.734 Reserved

529.735 Brakes

For rotorcraft with wheel-type landing gear, a braking device shall be installed that is:

(a) controllable by the pilot;

(b) useable during power-off landings; and

(c) adequate to:

(1) counteract any normal unbalanced torque when starting or stopping the rotor;and

(2) hold the rotorcraft parked on a 10 degree slope on a dry, smooth pavement.

529.736 Reserved

529.737 Skis

(a) The maximum limit load rating of each ski shall equal or exceed the maximum limit load determined under the applicable ground load requirements of this Chapter.

(b) There shall be a stabilizing means to maintain the ski in an appropriate position during flight. This means shall have enough strength to withstand the maximum aerodynamic and inertia loads on the ski.

529.738 to 529.750 Reserved

Floats and Hulls

529.751 Main Float Buoyancy

(a) For main floats, the buoyancy necessary to support the maximum weight of the rotorcraft in fresh water shall be exceeded by:

(1) 50 percent, for single floats; and

(2) 60 percent, for multiple floats.

(b) Each main float shall have enough watertight compartments so that, with any single main float compartment flooded, the main floats will provide a margin of positive stability great enough to minimize the probability of capsizing.

529.752 Reserved

529.753 Main Float Design

(a) Bag floats. Each bag float shall be designed to withstand:

(1) the maximum pressure differential that might be developed at the maximum altitude for which certification with the float is requested; and

(2) the vertical loads prescribed in section 529.521 (a), distributed along the length of the bag over three quarters of its projected area.

(b) Rigid floats. Each rigid float shall be able to withstand the vertical, horizontal and side loads prescribed in section 529.521. An appropriate load distribution under critical conditions shall be used.

529.754 Reserved

529.755 Hull Buoyancy

Water-based and amphibian rotorcraft. The hull and auxiliary floats, if used, shall have enough watertight compartments so that, with any single compartment of the hull or auxiliary floats flooded, the buoyancy of the hull and auxiliary floats, and wheel tires if used, provides a margin of positive water stability great enough to minimize the probability of capsizing the rotorcraft for the worst combination of wave heights and surface winds for which approval is desired.

529.756 Reserved

529.757 Hull and Auxiliary Float Strength

The hull, and auxiliary floats if used, shall withstand the water loads prescribed in section 529.519 with a rational and conservative distribution of local and distributed water pressures over the hull and float bottom.

529.758 to 529.770 Reserved

Personnel and Cargo Accommodations

529.771 Pilot Compartment

For each pilot compartment:

(a) the compartment and its equipment shall allow each pilot to perform his duties without unreasonable concentration or fatigue;

(b) if there is provision for a second pilot, the rotorcraft shall be controllable with equal safety from either pilot position. Flight and powerplant controls shall be designed to prevent confusion or inadvertent operation when the rotorcraft is piloted from either position;

(c) the vibration and noise characteristics of cockpit appurtenances shall not interfere with safe operation;

(d) in-flight leakage of rain or snow that could distract the crew or harm the structure shall be prevented.

529.772 *Reserved*

529.773 Pilot Compartment View

(a) Nonprecipitation conditions. For nonprecipitation conditions, the following apply:

(1) each pilot compartment shall be arranged to give the pilots a sufficiently extensive, clear, and undistorted view for safe operation;

(2) each pilot compartment shall be free of glare and reflection that could interfere

with the pilot's view. If certification for night operation is requested, this shall be demonstrated by night flight tests.

(b) Precipitation conditions. For precipitation conditions, the following apply:

(1) each pilot shall have a sufficiently extensive view for safe operation:

(i) in heavy rain at forward speeds up to V_H, and

(ii) in the most severe icing condition for which certification is requested;

(2) the first pilot shall have a window that:

(i) is openable under the conditions prescribed in (b)(1) of this section; and

(ii) provides the view prescribed in (b)(1) of this section.

529.774 Reserved

529.775 Windshield and Windows

Windshields and windows shall be made of material that will not break into dangerous fragments.

529.776 Reserved

529.777 Cockpit Controls

Cockpit controls shall be:

(a) located to provide convenient operation and to prevent confusion and inadvertent operation; and

(b) located and arranged with respect to the pilot's seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 5'2" to 6'0" in height are seated.

529.778 Reserved

529.779 Motion and Effect of Cockpit Controls

Cockpit controls shall be designed so that they operate in accordance with the following movements and actuation:

(a) flight controls, including the collective pitch control, shall operate with a sense of motion which corresponds to the effect on the rotorcraft;

(b) twist-grip engine power controls shall be designed so that, for left-hand operation, the motion of the pilot's hand is clockwise to increase power when the hand is viewed from the edge containing the index finger. Other engine power controls, excluding the collective control, shall operate with a forward motion to increase power; and

(c) normal landing gear controls shall operate downward to extend the landing gear.

529.780 to 529.782 Reserved

529.783 Doors

(a) Each closed cabin shall have at least one adequate and easily accessible external door.

(b) Each external door shall be located, and appropriate operating procedures shall be established, to ensure that, persons using the door will not be endangered by the rotors, propellers, engine intakes and exhausts when the operating procedures are used.

(c) There shall be means for locking crew and external passenger doors and for preventing their opening in flight inadvertently or as a result of mechanical failure. It shall be possible to open external doors from inside and outside the cabin with the rotorcraft on the ground even though persons may be crowded against the door on the inside of the rotorcraft. The means of opening shall be simple and obvious and so arranged and marked that it can be readily located and operated.

(d) There shall be reasonable provisions to prevent the jamming of any external doors in a minor crash as a result of fuselage deformation under the following ultimate inertial forces except for cargo or service doors not suitable for use as an exit in an emergency:

(1) upward - 1.5g;

(2) forward - 4.0g;

(3) sideward - 2.0g; and

(4) downward - 4.0g.

(e) There shall be means for direct visual inspection of the locking mechanism by crew members to determine whether the external doors (including passenger, crew, service and cargo doors) are fully locked. There shall be visual means to signal to appropriate crew members when normally used external doors are closed and fully locked.

(f) For outward opening external doors useable for entrance or egress, there shall be an auxiliary safety latching device to prevent the door from opening when the primary latching mechanism fails. If the door does not meet the requirements prescribed in (c) of this section with this device in place, suitable operating procedures shall be established to prevent the use of the device during take-off and landing.

(g) If an integral stair is installed in a passenger entry door that is qualified as a passenger emergency exit, the stair shall be designed so that under the following conditions the effectiveness of passenger emergency egress will not be impaired:

(1) the door, integral stair and operating mechanism have been subjected to the inertial forces specified in (d) of this section, acting separately relative to the surrounding structure;

(2) the rotorcraft is in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs, or primary members, as applicable, of the landing gear.

(h) Non-jettisonable doors used as ditching emergency exits shall have means to enable them to be secured in the open position and remain secure for emergency egress in sea state conditions prescribed for ditching.

529.784 Reserved

529.785 Seats, Berths, Litters, Safety Belts, and Harnesses

(amended 1998/11/23)

(a) Each seat, safety belt, harness and adjacent part of the rotorcraft at each station designated for occupancy during take-off and landing shall be free of potentially injurious objects, sharp edges, protuberances and hard surfaces and shall be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertial factors specified in section 529.561 (b) and dynamic conditions specified in section 529.562.

(b) Each occupant shall be protected from serious head injury by a safety belt plus a shoulder harness that will prevent the head from contacting any injurious object except as provided for in section 529.562 (c)(5). A shoulder harness (upper torso restraint), in combination with the safety belt, constitutes a torso restraint system as described in TSO-C114.

(c) Each occupant's seat shall have a combined safety belt and shoulder harness with a single point release. Each pilot's combined safety belt and shoulder harness shall allow each pilot when seated with safety belt and shoulder harness fastened to perform all functions necessary for flight operations. There shall be a means to secure belts and harnesses when not in use to prevent interference with the operation of the rotorcraft and with rapid egress in an emergency.

(d) If seat backs do not have a firm handhold, there shall be hand grips or rails along each aisle to let the occupants steady themselves while using the aisle in moderately rough air.

(e) Each projecting object that would injure persons seated or moving about in the rotorcraft in normal flight shall be padded.

(f) Each seat and its supporting structure shall be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertia forces and reactions between the occupant, seat, and safety belt or harness corresponding with the applicable flight and ground-load conditions, including the emergency landing conditions prescribed in section 529.561 (b). In addition:

(1) each pilot seat shall be designed for the reactions resulting from the application

of the pilot forces prescribed in section 529.397; and

(2) the inertial forces prescribed in section 529.561 (b) shall be multiplied by a factor of 1.33 in determining the strength of the attachment of:

(i) each seat to the structure, and

(ii) each safety belt or harness to the seat or structure.

(g) When the safety belt and shoulder harness are combined, the rated strength of the safety belt and shoulder harness shall not be less than that corresponding to the inertial forces specified in section 529.561(b), considering an occupant weight of at least 170 pounds, considering the dimensional characteristics of the restraint system installation, and using a distribution of at least 60 percent load to the safety belt and at least 40 percent load to the shoulder harness. If the safety belt is capable of being used with out the shoulder harness, the inertial forces specified shall be met by the safety belt alone.

(h) When a headrest is used, the headrest and its supporting structure shall be designed to resist the inertia forces specified in section 529.561, with a 1.33 fitting factor and a head weight of at least 13 pounds.

(i) Each seating device system includes the device such as the seat, the cushions, the occupant restraint system and attachment devices.

(j) Each seating device system may use design features such as crushing or separation of certain parts of the seat in the design to reduce occupant loads for the emergency landing dynamic conditions of section 529.562; otherwise, the system shall remain intact and shall not interfere with rapid evacuation of the rotorcraft.

(k) For the purpose of this section, a litter is defined as a device designed to carry a non-ambulatory person, primarily in a recumbent position, into and on the rotorcraft. Each berth or litter shall be designed to withstand the load reaction of an occupant weight of at least 170 pounds when the occupant is subjected to the forward inertial factors specified in section 529.561 (b). A berth or litter installed within 15° or less of the longitudinal axis of the rotorcraft shall be provided with a padded end-board, cloth diaphragm or equivalent means that can withstand the forward load reaction. A berth or litter oriented greater than 15° with the longitudinal axis of the rotorcraft shall be equipped with appropriate restraints, such as straps or safety belts, to withstand the forward load reaction. In addition:

(1) the berth or litter shall have a restraint system and shall not have corners or other protuberances likely to cause serious injury to a person occupying it during emergency landing conditions; and

(2) the berth or litter attachment and the occupant restraint system attachments to the structure shall be designed to withstand the critical loads resulting from flight and ground load conditions and from the conditions prescribed in section 529.561 (b). The fitting factor required by section 529.625 (d) shall be applied. (amended 1998/11/23)

529.786 Reserved

529.787 Cargo and Baggage Compartments

(a) Each cargo and baggage compartment shall be designed with the prescribed conditions of maximum weight of contents and for the critical load distributions at the appropriate maximum load factors corresponding to the specified flight and ground load conditions, except the emergency landing conditions of section 529.561.

(b) There shall be means to prevent the contents of any compartment from becoming a hazard by shifting under the loads specified in (a) of this section.

(c) Under the emergency landing conditions of section 529.561, cargo and baggage compartments shall:

(1) be positioned so that if the contents break loose, they are unlikely to cause injury to the occupants or restrict any of the escape facilities provided for use after an emergency landing; or

(2) have sufficient strength to withstand the conditions specified in section 529.561 including the means of restraint, and their attachments, required by (b) of this section. Sufficient strength shall be provided for the maximum authorized weight of cargo and baggage at the critical loading distribution.

(d) If cargo compartment lamps are installed, each lamp shall be installed so as to prevent contact between lamp bulb and cargo.

529.788 to 529.800 Reserved

529.801 Ditching

(a) If certification with ditching provisions is requested, the rotorcraft shall meet the requirements of this section and sections 529.807 (d), 529.1411 and 529.1415.

(b) Each practicable design measure, compatible with the general characteristics of the rotorcraft, shall be taken to minimize the probability that in an emergency landing on water, the behaviour of the rotorcraft would cause immediate injury to the occupants or would make it impossible for them to escape.

(c) The probable behaviour of the rotorcraft in a water landing shall be investigated by model tests or by comparison with rotorcraft of similar configuration for which the ditching characteristics are known. Scoops, flaps, projections and any other factors likely to affect the hydrodynamic characteristics of the rotorcraft shall be considered.

(d) It shall be demonstrated that, under reasonably probable water conditions, the flotation time and trim of the rotorcraft will allow the occupants to leave the rotorcraft and enter the life rafts required by section 529.1415. If compliance with this provision is demonstrated by buoyancy and trim computations, appropriate allowances shall be made for probable structural damage and leakage. If the rotorcraft has fuel tanks (with fuel jettisoning provisions) that can reasonably be expected to withstand a ditching

without leakage, the jettisonable volume of fuel may be considered as buoyancy volume.

(e) Unless the effects of the collapse of external doors and windows are accounted for in the investigation of the probable behaviour of the rotorcraft in a water landing (as prescribed in (c) and (d) of this section), the external doors and windows shall be designed to withstand the probable maximum local pressures.

529.802 Reserved

529.803 Emergency Evacuation

(a) Each crew and passenger area shall have means for rapid evacuation in a crash landing, with the landing gear (1) extended and (2) retracted, considering the possibility of fire.

(b) Passenger entrance, crew and service doors may be considered as emergency exits if they meet the requirements prescribed in this section and in sections 529.805 through 529.815.

(c) Reserved

(d) Except as provided in (e) of this section, the following categories of rotorcraft shall be tested in accordance with the requirements of Appendix D of this Chapter to demonstrate that the maximum seating capacity, including the crew members required by the operating rules, can be evacuated from the rotorcraft to the ground within 90 seconds:

(1) rotorcraft with a seating capacity of more than 44 passengers;

(2) rotorcraft with all of the following:

(i) ten or more passengers per passenger exit as determined under section 529.807 (b),

(ii) no main aisle, as described in section 529.815, for each row of passenger seats,

(iii) access to each passenger exit for each passenger by virtue of design features of seats, such as folding or break-over seat backs or folding seats.

(e) A combination of analysis and tests may be used to demonstrate that the rotorcraft is capable of being evacuated within 90 seconds under the conditions specified in section 529.803 (d) if the Minister finds that the combination of analysis and tests will provide data, with respect to the emergency evacuation capability of the rotorcraft, equivalent to that which would be obtained by actual demonstration.

529.804 Reserved

529.805 Flight Crew Emergency Exits

(a) For rotorcraft with passenger emergency exits that are not convenient to the flight crew, there shall be flight crew emergency exits, on both sides of the rotorcraft or as a top hatch, in the flight crew area.

(b) Each flight crew emergency exit shall be of sufficient size and shall be located so as to allow rapid evacuation of the flight crew. This shall be demonstrated by test.

(c) Each exit shall not be obstructed by water or flotation devices after a ditching. This shall be demonstrated by test, demonstration or analysis.

529.806 Reserved

529.807 Passenger Emergency Exits

(a) Type. For the purpose of this Chapter, the types of passenger emergency exits are as follows:

(1) Type I. This type shall have a rectangular opening of not less than 24 inches (610 mm) wide by 48 inches (1 220 mm) high, with corner radii not greater than one-third the width of the exit, in the passenger area in the side of the fuselage at floor level and as far away as practicable from areas that might become potential fire hazards in a crash;

(2) Type II. This type is the same as Type I, except that the opening shall be at least 20 inches (508 mm) wide by 44 inches (1 117 mm) high;

(3) Type III. This type is the same as Type I, except that:

(i) the opening shall be at least 20 inches (508 mm) wide by 36 inches (915 mm) high, and

(ii) the exits need not be at floor level;

(4) Type IV. This type shall have a rectangular opening of not less than 19 inches (483 mm) wide by 26 inches (660 mm) high, with corner radii not greater than one-third the width of the exit, in the side of the fuselage with a step-up inside the rotorcraft of not more than 29 inches (736 mm).

Openings with dimensions larger than those specified in this section may be used, regardless of shape, if the base of the opening has a flat surface of not less than the specified width.

(b) Passenger emergency exits; side of fuselage. Emergency exits shall be accessible to the passengers and, except as provided in (d) of this section, shall be provided in accordance with the following table:

Passenger Seating Capacity	Emergency Exits For Each Side Of The Fuselage			
	Type I	Type II	Type III	Type IV
1 through 10	....	....	....	1
11 through 19	....	....	1 or	2
20 through 39	....	1	....	1
40 through 59	1	....	....	1
60 through 79	1	....	1 or	2

***Information Note**: Refer to Preamble Change 529-4.*

(c) Passenger emergency exits with the rotorcraft resting on its side. In addition to the requirements prescribed in (b) of this section:
(amended 2003/12/01)

(1) there shall be enough openings in the fuselage to allow egress with the rotorcraft on its side;
(amended 2003/12/01)

(2) Deleted.
(amended 2003/12/01)

***Information Note**: FAR:* (c) *Passenger emergency exits with the rotorcraft resting on its side. In addition to the requirements of paragraph (b) of this section:*

(1) There must be enough openings in the top, bottom, or ends of the fuselage to allow evacuation with the rotorcraft on its side; or

(2) The probability of the rotorcraft coming to rest on its side in a crash landing must be extremely remote.

***Information Note**: Refer to Preamble Change 529-4.*

(d) Ditching emergency exits for passengers. If certification with ditching provisions is requested, ditching emergency exits shall be provided in accordance with the following requirements and shall be proven by test, demonstration or analysis unless the emergency exits required by (b) of this section already meet them:

(1) for rotorcraft that have a passenger seating configuration, excluding pilot seats, of nine seats or less, one exit above the waterline in each side of the rotorcraft, meeting at least the dimensions of a Type IV exit;

(2) for rotorcraft that have a passenger seating configuration, excluding pilot seats, of 10 seats or more, one exit above the waterline in a side of the rotorcraft meeting at least the dimensions of a Type III exit, for each unit (or part of a unit) of 35 passenger seats, but no less than two such exits in the passenger cabin, with one on each side of the rotorcraft. However, where it has been demonstrated through analysis, ditching demonstrations, or any other tests found necessary by the Minister, that the evacuation capability of the rotorcraft during ditching is improved by the use of larger exits, or by other means, the passenger seat to exit ratio may be

increased;

(3) flotation devices, whether stowed or deployed, shall not interfere with or obstruct the exits.

(e) Ramp exits. One Type I exit only, or one Type II exit only, that is required in the side of the fuselage under (b) of this section, may be installed instead in the ramp of floor ramp rotorcraft if:

(1) its installation in the side of the fuselage is impractical; and

(2) its installation in the ramp meets the requirements prescribed in section 529.813.

(f) Tests. The proper functioning of each emergency exit shall be demonstrated by test.

529.808 Reserved

529.809 Emergency Exit Arrangement

(a) Each emergency exit shall consist of a movable door or hatch in the external walls of the fuselage and shall provide an unobstructed opening to the outside.

(b) Each emergency exit shall be openable from the inside and from the outside.

(c) The means of opening each emergency exit shall be simple and obvious and shall not require exceptional effort.

(d) There shall be means for locking each emergency exit and for preventing opening in flight inadvertently or as a result of mechanical failure.

(e) There shall be means to minimize the probability of the jamming of any emergency exit in a minor crash landing as a result of fuselage deformation under the ultimate inertial forces prescribed in section 529.783(d).

(f) Except as provided in (h) of this section, each land-based rotorcraft emergency exit shall have an approved slide as stated in (g) of this section, or its equivalent, to assist occupants in descending to the ground from each floor level exit and an approved rope, or its equivalent, for all other exits, if the exit threshold is more that 6 feet above the ground:

(1) with the rotorcraft on the ground and with the landing gear extended;

(2) with one or more legs or part of the landing gear collapsed, broken or not extended; and

(3) with the rotorcraft resting on its side, if required by section 529.803 (d).

(g) The slide for each passenger emergency exit shall be a self-supporting slide or equivalent, and shall be designed to meet the following requirements:

(1) it shall be automatically deployed, and deployment shall begin during the interval between the time the exit opening means is actuated from inside the rotorcraft and the time the exit is fully opened. However, each passenger emergency

exit which is also a passenger entrance door or a service door shall be provided with means to prevent deployment of the slide when the exit is opened from either the inside or the outside under non emergency conditions for normal use;

(2) it shall be automatically erected within 10 seconds after deployment is begun;

(3) it shall be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs or part of the landing gear;

(4) it shall have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain useable after full deployment to evacuate occupants safely to the ground;

(5) each slide installation shall be qualified by five consecutive deployment and inflation tests conducted (per exit) without failure, and at least three tests of each such five-test series shall be conducted using a single representative sample of the device. The sample devices shall be deployed and inflated by the system's primary means after being subjected to the inertia forces specified in section 529.561 (b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction shall be corrected by positive means and after that, the full series of five consecutive deployment and inflation tests shall be conducted without failure.

(h) For rotorcraft having 30 or fewer passenger seats and having an exit threshold more than 6 feet above the ground, a rope or other assist means may be used in place of the slide specified in (f) of this section, provided an evacuation demonstration is accomplished as prescribed in section 529.803 (d) or (e).

(i) If a rope, with its attachment, is used for compliance with (f), (g), or (h) of this section, it shall:

(1) withstand a 400-pound static load; and

(2) attach to the fuselage structure at or above the top of the emergency exit opening, or at another approved location if the stowed rope would reduce the pilot's view in flight.

529.810 Reserved

529.811 Emergency Exit Marking

(a) Each passenger emergency exit, its means of access, and its means of opening shall be conspicuously marked for the guidance of occupants using the exits in daylight or in the dark. Such markings shall be designed to remain visible for rotorcraft equipped for overwater flights if the rotorcraft is capsized and the cabin is submerged.

(b) The identity and location of each passenger emergency exit shall be recognizable from a distance equal to the width of the cabin.

(c) The location of each passenger emergency exit shall be indicated by a sign visible to occupants approaching along the main passenger aisle. There shall be a locating sign:

(1) next to or above the aisle near each floor emergency exit, except that one sign may serve two exits if both exits can be seen readily from that sign; and

(2) on each bulkhead or divider that prevents fore and aft vision along the passenger cabin, to indicate emergency exits beyond and obscured by it, except that if this is not possible the sign may be placed at another appropriate location.

(d) Each passenger emergency exit marking and each locating sign shall have white letters 1 inch (25.4 mm) high on a red background 2 inches (50.8 mm) high, be self or electrically illuminated, and have a minimum luminescence (brightness) of at least 160 microlamberts. The colours may be reversed if this will increase the emergency illumination of the passenger compartment.

(e) The location of each passenger emergency exit operating handle and instructions for opening shall be identified:

(1) for each emergency exit, by a marking on or near the exit that is readable from a distance of 30 inches (760 mm); and

(2) for each Type I or Type II emergency exit with a locking mechanism released by rotary motion of the handle, by:

(i) a red arrow, with a shaft at least three-fourths inch (19 mm) wide and a head twice the width of the shaft, extending along at least 70° of arc at a radius approximately equal to three-fourths of the handle length, and

(ii) the word "open" in red letters 1 inch (25.4 mm) high, placed horizontally near the head of the arrow.

(f) Each emergency exit, and its means of opening, shall be marked on the outside of the rotorcraft. In addition, the following apply:

(1) there shall be a 2-inch (50.8 mm) coloured band outlining each passenger emergency exit, except small rotorcraft with a maximum weight or 12,500 pounds or less may have a 2-inch coloured band outlining each exit release lever or device of passenger emergency exits which are normally used doors; and

(2) each outside marking, including the band, shall have colon contrast to be readily distinguishable from the surrounding fuselage surface. The contrast shall be such that, if the reflectance of the darker colon is 15 percent or less, the reflectance of the lighter colon shall be at least 45 percent. "Reflectance" is the ratio of the luminous flux reflected by a body to the luminous flux it receives. When the reflectance of the darker colon is greater than 15 percent, at least a 30 percent difference between its reflectance and the reflectance of the lighter colon shall be provided.

(g) Exits marked as such, though in excess of the required number of exits, shall meet the requirements for emergency exits of the particular type. Emergency exits need only be marked with the word "Exit."

529.812 Emergency Lighting

For transport Category A rotorcraft, the following apply:

(a) A source of light with its power supply independent of the main lighting system shall be installed to:

(1) illuminate each passenger emergency exit marking and locating sign; and

(2) provide enough general lighting in the passenger cabin so that the average illumination, when measured at 40-inch (1.02 m) intervals at seat armrest height on the centre line of the main passenger aisle, is at least 0.05 foot-candles (0.538 lux);

(b) Exterior emergency lighting shall be provided at each emergency exit. The illumination shall not be less than 0.05 foot-candles (0.538 lux) (measured normal to the direction of incident light) for minimum width on the ground surface, with landing gear extended, equal to the width of the emergency exit where an evacuee is likely to make first contact with the ground outside the cabin. The exterior emergency lighting may be provided by either interior or exterior sources with light intensity measurements made with the emergency exits open;

(c) Each light required by (a) or (b) of this section, shall be operable manually from the cockpit station and from a point in the passenger compartment that is readily accessible. The cockpit control device shall have an "on", "off", and "armed" position so that when turned on at the cockpit or passenger compartment station or when armed at the cockpit station, the emergency lights will either illuminate or remain illuminated upon interruption of the rotorcraft's normal electric power;

(d) Any means required to assist the occupants in descending to the ground shall be illuminated so that the erected assist means is visible from the rotorcraft. The following apply:

(1) the assist means shall be provided with an illumination of not less than 0.03 foot-candles (0.324 lux) (measured normal to the direction of the incident light) at the ground end of the erected assist means where an evacuee using the established escape route would normally make first contact with the ground, with the rotorcraft in each of the attitudes corresponding to the collapse of one or more legs of the landing gear;

(2) if the emergency lighting subsystem illuminating the assist means is independent of the rotorcraft's main emergency lighting system, it:

(i) shall automatically be activated when the assist means is erected,

(ii) shall provide the illumination required by (d)(1) of this section, and

(iii) shall not be adversely affected by stowage;

(e) The energy supply to each emergency lighting unit shall provide the required level of illumination for at least 10 minutes at the critical ambient conditions after an emergency landing;

(f) If storage batteries are used as the energy supply for the emergency lighting system, they may be recharged from the rotorcraft's main electrical power system provided the charging circuit is designed to preclude inadvertent battery discharge into charging circuit faults.

529.813 Emergency Exit Access

(a) Each passageway between passenger compartments, and each passageway leading to Type I and Type II emergency exits, shall be:

(1) unobstructed; and

(2) at least 20 inches (508 mm) wide.

(b) For each emergency exit covered by section 529.809 (f), there shall be enough space adjacent to that exit to allow a crew member to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required for that exit.

(c) There shall be access from each aisle to each Type III and Type IV exit, and:

(1) for rotorcraft that have a passenger seating configuration, excluding pilot seats, of 20 or more, the projected opening of the exit provided shall not be obstructed by seats, berths, or other protrusions (including seatbacks in any position) for a distance from that exit of not less than the width of the narrowest passenger seat installed on the rotorcraft;

(2) for rotorcraft that have a passenger seating configuration, excluding pilot seats, of 19 or less, there may be minor obstructions in the region described in (c)(1) of this section, if there are compensating factors to maintain the effectiveness of the exit.

(d) It shall be demonstrated through the design of the rotorcraft that there is easy access to each usable emergency exit when the rotorcraft is resting on its side.
(amended 2003/12/01)

***Information Note**: No equivalent text is in the FAR.*

(1) Refer to Preamble Change 529-4.

529.814 Reserved

529.815 Main Aisle Width

The main passenger aisle width between seats shall equal or exceed the values in the following table:

Passenger Seating Capacity	Minimum Main Passenger Aisle Width	
	Less than 25 inches (635 mm) from floor	25 inches (635 mm) and more from floor
10 or less	12* inches (305 mm)	15 inches (457 mm)
11 through 19	12 inches (305 mm)	20 inches (508 mm)
20 or more	15 inches (381 mm)	20 inches (508 mm)
* A narrow width not less than 9 inches (229 mm) may be approved when substantiated by tests found necessary by the Minister.		

529.816 to 529.830 Reserved

529.831 Ventilation

(a) Each passenger and crew compartment shall be ventilated, and each crew compartment shall have enough fresh air (but not less than 10 cu. ft. per minute per crew member) to let crew members perform their duties without undue discomfort or fatigue.

(b) Crew and passenger compartment air shall be free from harmful or hazardous concentrations of gases or vapours.

(c) The concentration of carbon monoxide shall not exceed one part in 20,000 parts of air during forward flight. If the concentration exceeds this value under other conditions, there shall be suitable operating restrictions.

(d) There shall be means to ensure compliance with (b) and (c) of this section under any reasonably probable failure of any ventilating, heating, or other system or equipment.

529.832 Reserved

529.833 Heaters

Each combustion heater shall be approved.

529.834 to 529.850 Reserved

Fire Protection

529.851 Fire Extinguishers

(a) Hand fire extinguishers. For hand fire extinguishers the following apply:

(1) each hand fire extinguisher shall be approved;

(2) the kinds and quantities of each extinguishing agent used shall be appropriate to the kinds of fires likely to occur where that agent is used; and

(3) each extinguisher for use in a personnel compartment shall be designed to

minimize the hazard of toxic gas concentrations.

(b) Built-in fire extinguishers. If a built-in fire extinguishing system is required:

(1) the capacity of each system, in relation to the volume of the compartment where used and the ventilation rate, shall be adequate for any fire likely to occur in that compartment;

(2) each system shall be installed so that:

(i) no extinguishing agent likely to enter personnel compartments will be present in a quantity that is hazardous to the occupants, and

(ii) no discharge of the extinguisher can cause structural damage.

529.852 Reserved

529.853 Compartment Interiors

For each compartment to be used by the crew or passengers, the requirements of this section shall be met.

(a) The materials (including finishes or decorative surfaces applied to the materials) shall meet the following test criteria as applicable:

(1) interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) shall be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of Chapter 525 of this Manual, or other approved equivalent methods. The average burn length shall not exceed 6 inches (152 mm) and the average flame time after removal of the flame source shall not exceed 15 seconds. Drippings from the test specimen shall not continue to flame for more than an average of 3 seconds after falling;

(2) floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting joint and edge covering, cargo compartment liners, insulation blankets, cargo cover, and transparencies, moulded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing) that are constructed of materials not covered in (a)(3) of this section, shall be self extinguishing when tested vertically in accordance with the applicable portion of Appendix F of Chapter 525 of this Manual, or other approved equivalent methods. The average burn length shall not exceed 8 inches (203 mm) and the average flame time after removal of the flame source shall not exceed 15 seconds. Drippings from the test specimen shall not continue to flame for more than an average of 5 seconds after falling;

(3) acrylic windows and signs, parts constructed in whole or in part of elastometric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tie-down equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, shall not have an average burn rate greater than 2.5 inches (63 mm) per minute when tested horizontally in accordance with the applicable portions of Appendix F of Chapter 525 of this Manual, or other approved equivalent methods;

(4) except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Minister finds would not contribute significantly to the propagation of a fire, materials and items not specified in (a)(1), (a)(2), or (a)(3) of this section shall not have a burn rate greater than 4 inches (102 mm) per minute when tested horizontally in accordance with the applicable portions of Appendix F of Chapter 525 of this Manual, or other approved equivalent methods.

(b) In addition to meeting the requirements prescribed in (a)(2) of this section, seat cushions, except those on flight crew member seats, shall meet the test requirements of Part II of Appendix F of Chapter 525 of this Manual, or equivalent.

(c) If smoking is to be prohibited, there shall be a placard so stating, and if smoking is to be allowed:

(1) where shall be an adequate number of self-contained removable ashtrays, and

(2) where the crew compartment is separated from the passenger compartment, there shall be at least one illuminated sign (using either letters or symbols) notifying all passengers when smoking is prohibited. Signs, which notify when smoking is prohibited, shall:

(i) when illuminated, be legible to each passenger seated in the passenger cabin under all probable lighting conditions, and

(ii) be so constructed that the crew can turn the illumination on and off;

(d) Each receptacle for towels, paper, or waste shall be at least fire-resistant and shall have means for containing possible fires;

(e) There shall be a hand fire extinguisher for the flight crew members;

(f) At least the following number of hand fire extinguishers shall be conveniently located in passenger compartments:

Passenger Capacity	Fire Extinguishers
7 through 30	1
31 through 60	2
61 or more	3

529.854 Reserved

529.855 Cargo and Baggage Compartments

(a) Each cargo and baggage compartment shall be constructed of, or lined with materials in accordance with the following:

(1) for accessible and inaccessible compartments not occupied by passengers or crew, the material shall be at least fire resistant;

(2) materials shall meet the requirements prescribed in section 529.853 (a)(1), (a)(2), and (a)(3) for cargo or baggage compartments in which:

(i) the presence of a compartment fire would be easily discovered by a crew member while at the crew member's station,

(ii) each part of the compartment is easily accessible in flight,

(iii) the compartment has a volume of 200 cubic feet or less, and

(iv) notwithstanding section 529.1439 (a), protective breathing equipment is not required.

(b) No compartment shall contain any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operation, unless those items are protected so that:

(1) they cannot be damaged by the movement of cargo in the compartment; and

(2) their breakage or failure will not create a fire hazard.

(c) The design and sealing of inaccessible compartments shall be adequate to contain compartment fires until a landing and safe evacuation can be made.

(d) Each cargo and baggage compartment that is not sealed so as to contain cargo compartment fires completely without endangering the safety of a rotorcraft or its occupants shall be designed, or shall have a device, to ensure detection of fires or smoke by a crew member while at his station and to prevent the accumulation of harmful quantities of smoke, flame, extinguishing agents, and other noxious gases in any crew or passenger compartment. This shall be demonstrated in flight.

(e) For rotorcraft used for the carriage of cargo only, the cabin area may be considered a cargo compartment and, in addition to (a) through (d) of this section, the following apply:

(1) there shall be means to shut off the ventilating airflow to or within the compartment. Controls for this purpose shall be accessible to the flight crew in the crew compartment.

(2) required crew emergency exits shall be accessible under all cargo loading conditions.

(3) sources of heat within each compartment shall be shielded and insulated to

prevent igniting the cargo.

529.856 to 529.858 Reserved

529.859 Combustion Heater Fire Protection

(a) Combustion heater fire zones. The following combustion heater fire zones shall be protected against fire under the applicable provisions of sections 529.1181 through 529.1191, and sections 529.1195 through 529.1203:

(1) the region surrounding any heater, if that region contains any flammable fluid system components (including the heater fuel system), that could:

(i) be damaged by heater malfunctioning, or

(ii) allow flammable fluids or vapours to reach the heater in case of leakage;

(2) each part of any ventilating air passage that:

(i) surround the combustion chamber, and

(ii) would not contain (without damage to other rotorcraft components) any fire that may occur within the passage.

(b) Ventilating air ducts. Each ventilating air duct passing through any fire zone shall be fireproof. In addition:

(1) unless isolation is provided by fireproof valves or by equally effective means, the ventilating air duct downstream of each heater shall be fireproof for a distance great enough to ensure that any fire originating in the heater can be contained in the duct; and

(2) each part of any ventilating duct passing through any region having a flammable fluid system shall be so constructed or isolated from that system that the malfunctioning of any component of that system cannot introduce flammable fluids or vapours into the ventilating airstream.

(c) Combustion air ducts. Each combustion air duct shall be fireproof for a distance great enough to prevent damage from backfiring or reverse flame propagation. In addition:

(1) no combustion air duct shall communicate with the ventilating airstream unless flames from backfires or reverse burning cannot enter the ventilating airstream under any operating condition, including reverse flow or malfunction of the heater or its associated components; and

(2) no combustion air duct shall restrict the prompt relief of any backfire that, if so restricted, could cause heater failure.

(d) Heater controls; general. There shall be means to prevent the hazardous accumulation of water or ice on or in any heater control component, control system tubing, or safety control.

(e) Heater safety controls. For each combustion heater, safety control means shall be provided as follows:

(1) means independent of the components provide for the normal continuous control of air temperature, airflow, and fuel flow shall be provided, for each heater, to automatically shut off the ignition and fuel supply of that heater at a point remote from that heater when any of the following occurs:

(i) the heat exchanger temperature exceeds safe limits,

(ii) the ventilating air temperature exceeds safe limits,

(iii) the combustion airflow becomes inadequate for safe operation, and

(iv) the ventilating airflow becomes inadequate for safe operation;

(2) the means of complying with (e)(1) of this section for any individual heater shall:

(i) be independent of components serving any other heater whose heat output is essential for safe operation, and

(ii) keep the heater off until restarted by the crew;

(3) there shall be means to warn the crew when any heater whose heat output is essential for safe operation has been shut off by the automatic means prescribed in (e)(1) of this section.

(f) Air intakes. Each combustion and ventilating air intake shall be where no flammable fluids or vapours can enter the heater system under any operating condition:

(1) during normal operation; or

(2) as a result of the malfunction of any other component.

(g) Heater exhaust. Each heater exhaust system shall meet the requirements of sections 529.1121 and 529.1123. In addition:

(1) each exhaust shroud shall be sealed so that no flammable fluids or hazardous quantities of vapours can reach the exhaust systems through joints; and

(2) no exhaust system shall restrict the prompt relief of any backfire that, if so restricted, could cause heater failure.

(h) Heater fuel systems. Each heater fuel system shall meet the powerplant fuel system requirements affecting safe heater operation. Each heater fuel system component in the ventilating airstream shall be protected by shrouds so that no leakage from those components can enter the ventilating airstream.

(i) Drains. There shall be means for safe drainage of any fuel that might accumulate in the combustion chamber or the heat exchanger. In addition:

(1) each part of any drain that operates at high temperatures shall be protected in the same manner as heater exhausts; and

(2) each drain shall be protected against hazardous ice accumulation under any operating condition.

529.860 Reserved

529.861 Fire Protection of Structure, Controls, and Other Parts

Each part of the structure, controls and the rotor mechanism, and other parts essential to controlled landing and (for Category A) flight that would be affected by powerplant fires, shall be isolated under section 529.1191, or shall be:

(a) for Category A rotorcraft, fireproof; and

(b) for Category B rotorcraft, fireproof or protected so that they can perform their essential functions for at least 5 minutes under any foreseeable powerplant fire condition.

529.862 Reserved

529.863 Flammable Fluid Fire Protection

(a) In each area where flammable fluids or vapours might escape by leakage of a fluid system, there shall be means to minimize the probability of ignition of the fluids and vapours, and the resultant hazards if ignition does occur.

(b) Compliance with (a) of this section shall be demonstrated by analysis or tests, and the following factors shall be considered:

(1) possible sources and paths of fluid leakage, and means of detecting leakage;

(2) flammability characteristics of fluids, including effects of any combustible or absorbing materials;

(3) possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices;

(4) means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents; and

(5) ability of rotorcraft components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g. equipment shutdown or actuation of a fire extinguisher), quick acting means shall be provided to alert the crew.

(d) Each area where flammable fluids or vapours might escape by leakage of a fluid system shall be identified and defined.

529.864 Reserved

External Loads
(amended 1999/12/01)

529.865 External Loads
(amended 1999/12/01)

(a) It shall be demonstrated by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under sections 529.337 through 529.341, multiplied by the maximum external load for which authorization is requested. It shall be demonstrated by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under sections 529.337 through 529.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, shall be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load shall also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if:
(amended 1999/12/01)

(1) an operating limitation is established limiting external load operations to such angles for which compliance with this has been demonstrated; or

(2) it is demonstrated that the lesser angle shall not be exceeded in service.

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, shall include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system shall consist of a primary quick-release subsystem and a backup quick-release subsystem that are isolated from one another. The quick-release system, and the means by which it is controlled, shall comply with the following:
(amended 1999/12/01)

(1) a control for the primary quick-release subsystem shall be installed either on one of the pilot's primary controls or in an equivalently accessible location and shall be designed and located so that it may be operated by either the pilot or a crew member without hazardously limiting the ability to control the rotorcraft during an emergency situation;

(2) a control for the backup quick-release subsystem, readily accessible to either the pilot or another crew member, shall be provided;

(3) both the primary and backup quick release subsystems shall:

(i) be reliable, durable, and function properly with all external loads up to and including the maximum external limit load for which authorization is requested,

(ii) be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release;

(A) the minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per metre, and

(B) the minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per metre, and

(iii) be protected against any failure that could be induced be a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft shall:
(amended 1999/12/01)

(1) for jettisonable external loads, have a quick-release systems that meets the requirements of (b) of this section and that:

(i) provides a dual actuation device for the primary quick-release subsystem, and

(ii) provides a separate dual actuation device for the backup quick-release subsystem;

(2) have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety;

(3) have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, ingress and egress instructions;

(4) have equipment to allow direct intercommunication among required crew members and external occupants;

(5) have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations; and

(6) for human external cargo applications requiring use of Category A rotorcraft, have one-engine-inoperative hover performance data and procedures in the flight manual for the weights, altitudes, and temperatures for which external load approval is requested.

(d) The critically configured jettisonable external loads shall be demonstrated by a combination of analysis, ground tests and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads shall be

demonstrated to be releasable without hazard to the rotorcraft during emergency flight conditions.
(amended 1999/12/01)

(e) A placard or marking shall be installed next to the external load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under section 529.25 and this section.
(amended 1999/12/01)

(f) The fatigue evaluation of section 529.571 of this chapter does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of section 529.571 of this chapter applies to the entire quick-release and personnel carrying device structural systems and their attachments.
(amended 1999/12/01)

529.866 to 529.870 Reserved

Miscellaneous

529.871 Levelling Marks

There shall be reference marks for levelling the rotorcraft on the ground.

529.872 Reserved

529.873 Ballast Provisions

Ballast provisions shall be designed and constructed to prevent inadvertent shifting of ballast in flight.

529.874 *to 529.900 Reserved*

SUBCHAPTER E
POWERPLANT - GENERAL

529.901 Installation

(a) For the purpose of this chapter, the powerplant installation includes each part of the rotorcraft (other than the main and auxiliary rotor structures) that:

(1) is necessary for propulsion;

(2) affects the control of the major propulsive units; or

(3) affects the safety of the major propulsive units between normal inspections or overhauls.

(b) For each powerplant installation:

(1) the installation shall comply with:

(i) the installation instructions provided under section 533.5 of Chapter 533533.5 of this Manual, and

(ii) the applicable provisions of this subchapter;

(2) each component of the installation shall be constructed, arranged, and installed to ensure its continued safe operation between normal inspections or overhauls for the range of temperature and altitude for which approval is requested;

(3) accessibility shall be provided to allow any inspection and maintenance necessary for continued airworthiness;

(4) electrical interconnections shall be provided to prevent differences of potential between major components of the installation and the rest of the rotorcraft;

(5) axial and radial expansion of turbine engines shall not affect the safety of the installation; and

(6) design precautions shall be taken to minimize the possibility of incorrect assembly of components and equipment essential to safe operation of the rotorcraft, except where operation with the incorrect assembly can be demonstrated to be extremely improbable.

(c) For each powerplant or auxiliary power unit installation, it shall be established that no single failure or malfunction or probable combination of failures will jeopardize the safe operation of the rotorcraft except that the failure of structural elements need not be considered if the probability of any such failure is extremely remote.
(amended 1997/04/07)

(d) Each auxiliary power unit installation shall meet the applicable provisions of this subchapter.

529.902 Reserved

529.903 Engines

(a) Engine type certification. Each engine shall have an approved type certificate. Reciprocating engines for use in helicopters shall be qualified in accordance with section 533.49 (d) of this manual or be otherwise approved for the intended usage.

(b) Category A; engine isolation. For each category A rotorcraft, the powerplants shall be arranged and isolated from each other to allow operation, in at least one configuration, so that the failure or malfunction of any engine, or the failure of any system that can affect any engine, will not:

(1) prevent the continued safe operation of the remaining engines; or

(2) require immediate action other than normal pilot action with primary flight controls, by any crew member to maintain safe operation.

(c) Category A; control of engine rotation. For each category A rotorcraft, there shall be a means for stopping the rotation of any engine individually in flight, except for turbine engine installations where the means for stopping the engine need to be provided only where necessary for safety. In addition:

(1) each component of the engine stopping system that is located on the engine side of the firewall, and that might be exposed to fire, shall be at least fire resistant; or

(2) duplicate means shall be available for stopping the engine and the controls shall be where all are not likely to be damaged at the same time in case of fire.

(3) Removed.
(amended 1997/04/07)

(d) Turbine engine installation. For turbine engine installations:
(amended 1997/04/07)

(1) design precautions shall be taken to minimize the hazards to the rotorcraft in the event of an engine rotor failure; and

(2) the powerplant systems associated with engine control devices, systems, and instrumentation shall be designed to give reasonable assurance that those engine operating limitations that adversely affect engine rotor structural integrity will not be exceeded in service.

(e) Restart capability.

(1) A means to restart any engine in flight shall be provided;

(2) Except for the in-flight shutdown of all engines, engine restart capability shall be demonstrated throughout a flight envelope for the rotorcraft;

(3) Following the in-flight shutdown of all engines, in-flight engine restart capability shall be provided.

529.904 to 529.506 Reserved

529.907 Engine Vibration

(a) Each engine shall be installed to prevent the harmful vibration of any part of the engine or rotorcraft.

(b) The addition of the rotor and the rotor drive system to the engine shall not subject the principal rotating parts of the engine to excessive vibration stresses. This shall be demonstrated by a vibration investigation.

529.908 Cooling Fans

For cooling fans that are a part of a powerplant installation the following apply:

(a) Category A. For cooling fans installed in Category A rotorcraft, it shall be demonstrated that a fan blade failure will not prevent continued safe flight either because of damage caused by the failed blade or loss of cooling air.

(b) Category B. For cooling fans installed in category B rotorcraft, there shall be means to protect the rotorcraft and allow a safe landing if a fan blade fails. It shall be demonstrated that:

(1) the fan blade would be contained in the case of a failure;

(2) each fan is located so that a fan blade failure will not jeopardize safety; or

(3) each fan blade can withstand an ultimate load of 1.5 times the centrifugal force expected in service, limited by either:

(i) the highest rotational speeds achievable under uncontrolled conditions, or

(ii) an overspeed limiting device.

(c) Fatigue evaluation. Unless a fatigue evaluation under section 529.571 is conducted, it shall be demonstrated that cooling fan blades are not operating at resonant conditions within the operating limits of the rotorcraft.

529.909 to 529.916 Reserved

Rotor Drive System

529.917 Design

(a) General. The rotor drive system includes any part necessary to transmit power from the engines to the rotor hubs. This includes gear boxes, shafting, universal joints, couplings, rotor brake assemblies, clutches, supporting bearings for shafting, any attendant accessory pads or drives, and any cooling fans that are a part of, attached to, or mounted on the rotor drive system.

(b) Design Assessment. A design assessment shall be performed to ensure that the rotor drive system functions safely over the full range of conditions for which certification is

sought. The design assessment shall include a detailed failure analysis to identify all failures that will prevent continued safe flight or safe landing and shall identify the means to minimize the likelihood of their occurrence.
(amended 1997/04/07)

(c) Arrangement. Rotor drive systems shall be arranged as follows:

(1) each rotor drive system of multi-engine rotorcraft shall be arranged so that each rotor necessary for operation and control will continue to be driven by the remaining engines if any engine fails;

(2) for single-engine rotorcraft, each rotor drive system shall be so arranged that each rotor necessary for control in autorotation will continue to be driven by the main rotors after disengagement of the engine from the main and auxiliary rotors;

(3) each rotor drive system shall incorporate a unit for each engine to automatically disengage that engine from the main and auxiliary rotors if that engine fails;

(4) if a torque limiting device is used in the rotor drive system, it shall be located so as to allow continued control of the rotorcraft when the device is operating;

(5) if the rotors shall be phased for intermeshing, each system shall provide constant and positive phase relationship under any operating condition; and

(6) if a rotor dephasing device is incorporated, there shall be means to keep the rotors locked in proper phase before operation.

529.918 to 529.20 Reserved

529.921 Rotor Brake

If there is a means to control the rotation of the rotor drive system independently of the engine, any limitations on the use of that means shall be specified, and the control for that means shall be guarded to prevent inadvertent operation.

529.922 Reserved

529.923 Rotor Drive System and Control Mechanism Tests

(a) Endurance tests, general. Each rotor drive system and rotor control mechanism shall be tested, as prescribed in (b) through (n) and (p) of this section, for at least 200 hours plus the time required to meet the requirements of (b)(2), (b)(3), and (k) of this section. These tests shall be conducted as follows:
(amended 1998/11/23)

(1) ten-hour test cycles shall be used, except that the test cycle shall be extended to include the OEI test of (b)(2) and (k), of this section, if OEI ratings are requested;

(2) the tests shall be conducted on the rotorcraft;

(3) the test torque and rotational speed shall be:

(i) determined by the powerplant limitations, and

(ii) absorbed by the rotors to be approved for the rotorcraft.

(b) Endurance tests, take-off run. The take-off run shall be conducted as follows:

(1) except as prescribed in (b)(2) and (b)(3) of this section, the take-off torque run shall consist of 1 hour of alternate runs of 5 minutes at take-off torque and the maximum speed for use with take-off torque and 5 minutes at as low an engine idle speed as practicable. The engine shall be declutched from the rotor drive system, and the rotor brake, if furnished and so intended, shall be applied during the first minute of the idle run. During the remaining 4 minutes of the idle run, the clutch shall be engaged so that the engine drives the rotors at the minimum practical r.p.m. The engine and the rotor drive system shall be accelerated at the maximum rate. When declutching the engine, it shall be decelerated rapidly enough to allow the operation of the overrunning clutch;

(2) for helicopters for which the use of 2 minute 30 second-OEI rating is requested, the take-off run shall be conducted as prescribed in (b)(1) of this section, except for the third and sixth runs for which the take-off torque and the maximum speed for use with take-off torque are prescribed in (b)(1) of this section. For these runs, the following apply:

(i) each run shall consist of at least one period of 2 minutes 30 seconds with the take-off torque and the maximum speed for use with take-off torque on all engines, and

(ii) each run shall consist of at least one period, for each engine in sequence, during which that engine simulates a power failure and the remaining engines are run at the 2 minute 30 second-OEI torque and the maximum speed for use with 2 minute 30 second-OEI torque for 2 minutes 30 seconds; and

(3) for multi-engine, turbine-powered rotorcraft for which the use of 30 second 2 minute-OEI power is requested, the take-off run shall be conducted as prescribed in (b)(1) of this section except for the following:

(i) immediately following any one 5 minute power-on run prescribed by (b)(1) of this section, simulate a failure for each power source in turn, and apply the maximum torque and the maximum speed for use with 30 second-OEI power to the remaining affected drive system power inputs for not less than 30 seconds. Each application of 30 second-OEI power shall be followed by two applications of the maximum torque and the maximum speed for use with 2 minute-OEI power for not less than 2 minutes each. The second application shall follow a period at stabilized continuous or 30 minute-OEI power (whichever is requested by the applicant). At least one run sequence shall be conducted from a simulated "flight idle" condition. When conducted on a bench test, the test sequence shall be conducted following stabilization at take-off power,

(amended 1997/04/07)

(ii) for the purpose of (b)(3) of this section, an affected power input includes all parts of the rotor drive system which can be adversely affected by the application of higher or asymmetric torque and speed prescribed by the test, and

(iii) this test may be conducted on a representative bench test facility when engine limitations either preclude repeated use of this power or would result in premature engine removals during the test. The loads, the vibration frequency, and the methods of application to the affected rotor drive system components shall be representative of rotorcraft conditions. Test components shall be those used to demonstrate compliance with the remainder of this section.

(c) Endurance tests; maximum continuous run. Three hours of continuous operation at maximum continuous torque and the maximum speed for use with maximum continuous torque shall be conducted as follows:

(1) the main rotor controls shall be operated at a minimum of 15 times each hour through the main rotor pitch positions of maximum vertical thrust, maximum forward thrust component, maximum aft thrust component, maximum left thrust component, and maximum right thrust component, except that the control movements need not produce loads or blade flapping motion exceeding the maximum loads of motions encountered in flight;

(2) the directional controls shall be operated at a minimum of 15 times each hour through the control extremes of maximum right turning torque, neutral torque as required by the power applied to the main rotor, and maximum left turning torque; and

(3) each maximum control position shall be held for at least 10 seconds, and the rate of change of control position shall be at least as rapid as that for normal operation.

(d) Endurance tests; 90 percent of maximum continuous run. One hour of continuous operation at 90 percent of maximum continuous torque and the maximum speed for use with 90 percent of maximum continuous torque shall be conducted.

(e) Endurance tests; 80 percent of maximum continuous run. One hour of continuous operation at 80 per cent of maximum continuous torque and the minimum speed for use with 80 percent of maximum continuous torque shall be conducted.

(f) Endurance tests; 60 percent of maximum continuous run. Two hours or, for helicopters for which the use of either 30 minute-OEI power or continuous OEI power is requested, 1 hour of continuous operation at 60 percent of maximum continuous torque and the minimum speed for use with 60 percent of maximum continuous torque shall be conducted.

(g) Endurance tests; engine malfunctioning run. It shall be determined whether malfunctioning of components such as the engine fuel or ignition systems, or whether unequal engine power can cause dynamic conditions detrimental to the drive system. If

so, a suitable number of hours of operation shall be accomplished under those conditions, 1 hour of which shall be included in each cycle, and the remaining hours of which shall be accomplished at the end of the 20 cycles. If no detrimental condition results, an additional hour of operation in compliance with (b) of this section shall be conducted in accordance with the run schedule of (b)(1) of this section without consideration of (b)(2) of this section.

(h) Endurance tests; overspeed run. One hour of continuous operation shall be conducted at maximum continuous torque and the maximum power-on overspeed expected in service, assuming that speed and torque limiting devices, if any, function properly.

(i) Endurance tests; rotor control positions. When the rotor controls are not being cycled during the tiedown tests, the rotor shall be operated, using the procedures prescribed in (c) of this section, to produce each of the maximum thrust positions for the following percentages of test time (except that the control positions need not produce loads or blade flapping motion exceeding the maximum loads or motions encountered in flight):

(1) for full vertical thrust, 20 percent;

(2) for the forward thrust component, 50 percent;

(3) for the right thrust component, 10 percent;

(4) for the left thrust component, 10 percent; and

(5) for the aft thrust component, 10 percent.

(j) Endurance tests, clutch and brake engagements. A total of at least 400 clutch and brake engagements, including the engagements of (b) of this section, shall be made during the take-off torque runs and, if necessary, at each change of torque and speed throughout the test. In each clutch engagement, the shaft on the driven side of the clutch shall be accelerated from rest. The clutch engagements shall be accomplished at the speed and by the method prescribed by the applicant. During deceleration after each clutch engagement, the engines shall be stopped rapidly enough to allow the engines to be automatically disengaged from the rotors and rotor drives. If a rotor brake is installed for stopping the rotor, the clutch, during brake engagements, shall be disengaged above 40 percent of maximum continuous rotor speed and the rotors allowed to decelerate to 40 percent of maximum continuous rotor speed, at which time the rotor brake shall be applied. If the clutch design does not allow stopping the rotors with the engine running, or if no clutch is provided, the engine shall be stopped before each application of the rotor brake, and then immediately be started after the rotors stop.

(k) Endurance tests, OEI power run:

(1) 30 minute-OEI power run. For rotorcraft for which the use of 30 minute-OEI power is requested, a run at 30 minute-OEI torque and the maximum speed for use

with 30 minute-OEI torque shall be conducted as follows: for each engine, in sequence, that engine shall be inoperative and the remaining engines shall run for a 30 minute period.

(2) Continuous OEI power run. For rotorcraft for which the use of continuous OEI power is requested, a run at continuous OEI torque and the maximum speed for use with continuous OEI torque shall be conducted as follows: for each engine, in sequence, that engine shall be inoperative and the remaining engines shall be run for 1 hour.

(3) The number of periods prescribed in (k)(1) or (k)(2) of this section shall not be less than the number of engines, nor shall it be less than two.

(l) Reserved.

(m) Any components that are affected by manoeuvring and gust loads shall be investigated for the same flight conditions as are the main rotors, and their service lives shall be determined by fatigue tests or by other acceptable methods. In addition, a level of safety equal to that of the main rotors shall be provided for:

(1) each component in the rotor drive system whose failure would cause an uncontrolled landing;

(2) each component essential to the phasing of rotors on multi-rotor rotorcraft, or that furnishes a driving link for the essential control of rotors in autorotation; and

(3) each component common to two or more engines on multi-engine rotorcraft.

(n) Special tests. Each rotor drive system designed to operate at two or more gear ratios shall be subjected to special testing for durations necessary to substantiate the safety of the rotor drive system.

(o) Each part tested as prescribed in this section shall be in a serviceable condition at the end of the tests. No intervening disassembly, which might affect test results, shall be conducted.

(p) Endurance tests; operating lubricants. To be approved for use in rotor drive and control systems, lubricants shall meet the specifications of lubricants used during the tests prescribed by this section. Additional or alternate lubricants may be qualified by equivalent testing or by comparative analysis of lubricant specifications and rotor drive and control system characteristics. In addition:

(1) at least three 10-hour cycles required by this section shall be conducted with transmission and gearbox lubricant temperatures, at the location prescribed for measurement, not lower than the maximum operating temperature for which approval is requested;

(2) for pressure lubricated systems, at least three 10-hour cycles required by this section shall be conducted with the lubricant pressure, at the location prescribed for measurement, not higher than the minimum operating pressure for which approval is

requested; and

(3) the test conditions prescribed in (p)(1) and (p)(2) of this section shall be applied simultaneously and shall be extended to include operation at any one-engine-inoperative rating for which approval is requested.

529.924 to 529.926 Reserved

529.927 Additional Tests

(a) Any additional dynamic, endurance, and operational tests, and vibratory investigations necessary to determine that the rotor drive mechanism is safe, shall be performed.

(b) If turbine engine torque output to the transmission can exceed the highest engine or transmission torque limit, and that output is not directly controlled by the pilot under normal operating conditions (such as where the primary engine power control is accomplished through the flight control), the following test shall be made:

(1) under conditions associated with all engines operating, make 200 applications, for 10 seconds each, of torque that is at least equal to the lesser of:

(i) the maximum torque used in meeting section 529.923 plus 10 percent, or

(ii) the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly;

(2) for multi-engine rotorcraft under conditions associated with each engine, in turn, becoming inoperative, apply to the remaining transmission torque inputs the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly. Each transmission input shall be tested at this maximum torque for at least fifteen minutes.

(c) Lubrication system failure. For lubrication systems required for proper operation of rotor drive systems, the following apply:

(1) Category A. Unless such failures are extremely remote, it shall be demonstrated by test that any failure which results in loss of lubricant in any normal use lubrication system will not prevent continued safe operation, although not necessarily without damage, at a torque and rotational speed prescribed by the applicant for continued flight, for at least 30 minutes after perception by the flight crew of the lubrication system failure or loss of lubricant;

(2) Category B. The requirements of Category A apply except that the rotor drive system need only be capable of operating under autorotative conditions for at least 15 minutes.

(d) Overspeed test. The rotor drive system shall be subjected to 50 overspeed runs, each 30±3 seconds in duration, at not less than either the higher of the rotational speed to be expected from an engine control device failure or 105 percent of the maximum

rotational speed, including transients, to be expected in service. If speed and torque limiting devices are installed, are independent of the normal engine control, and are demonstrated to be reliable, their rotational speed limits need not be exceeded. These runs shall be conducted as follows:

(1) overspeed runs shall be alternated with stabilizing runs of from 1 to 5 minutes duration each at 60 to 80 percent of maximum continuous speed;

(2) acceleration and deceleration shall be accomplished in a period not longer than 10 seconds (except where maximum engine acceleration rate will require more than 10 seconds), and the time for changing speeds shall not be deducted from the specified time for the overspeed runs; and

(3) overspeed runs shall be made with the rotors in the flattest pitch for smooth operation.

(e) The tests prescribed in (b) and (d) of this section shall be conducted on the rotorcraft and the torque shall be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of torque absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

(f) Each test prescribed by this section shall be conducted without intervening disassembly and, except for the lubrication system failure test required by (c) of this section, each part tested shall be in a serviceable condition at the conclusion of the test.

529.928 to 529.930 Reserved

529.931 Shafting Critical Speed

(a) The critical speeds of any shafting shall be determined by demonstration except that analytical methods may be used if reliable methods of analysis are available for the particular design.

(b) If any critical speed lies within, or close to, the operating ranges for idling, power-on, and autorotative conditions, the stresses occurring at that speed shall be within safe limits. This shall be demonstrated by tests.

(c) If analytical methods are used and demonstrate that no critical speed lies within the permissible operating ranges, the margins between the calculated critical speeds and the limits of the allowable operating ranges shall be adequate to allow for possible variations between the computed and actual values.

529.932 to 529.934 Reserved

529.935 Shafting Joints.

Each universal joint, slip joint, and other shafting joints whose lubrication is necessary for operation shall have provision for lubrication.

529.936 to 529.938 Reserved

529.939 Turbine Engine Operating Characteristics

(a) Turbine engine operating characteristics shall be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flameout) are present, to a hazardous degree, during normal and emergency operation within the range of operating limitations of the rotorcraft and of the engine.

(b) The turbine engine air inlet system shall not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

(c) For governor-controlled engines, it shall be demonstrated that there exists no hazardous torsional instability of the drive system associated with critical combinations of power, rotational speed, and control displacement.

529.940 to 529.950 Reserved

Fuel System

529.951 General

(a) Each fuel system shall be constructed and arranged to ensure a flow of fuel at a rate and pressure established for proper engine and auxiliary power unit functioning under any likely operating conditions, including the manoeuvres for which certification is requested and during which the engine or auxiliary power unit is permitted to be in operation.

(b) Each fuel system shall be arranged so that:

(1) no engine or fuel pump can draw fuel from more than one tank at a time; or

(2) there are means to prevent introducing air into the system.

(c) Each fuel system for a turbine engine shall be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 80° F. and having 0.75 cc. of free water per gallon added and cooled to the most critical condition for icing likely to be encountered in operation.

529.952 Fuel System Crash Resistance

Unless other means acceptable to the Minister are employed to minimize the hazard of fuel fires to occupants following an otherwise survivable impact (crash landing), the fuel systems shall incorporate the design features of this section. These systems shall be demonstrated to be capable of sustaining the static and dynamic deceleration loads of this section, considered as ultimate loads acting alone, measured at the system component's centre of gravity, without structural damage to system components, fuel tanks, or their attachments that would leak fuel to an ignition source.
(amended 1995/06/05)

(a) Drop test requirements. Each tank, or the most critical tank, shall be drop-tested as follows:
(amended 1995/06/05)

(1) the drop height shall be at least 50 feet;

(2) the drop impact surface shall be non-deforming;

(3) the tank shall be filled with water to 80 percent of the normal, full capacity;

(4) the tank shall be enclosed in a surrounding structure representative of the installation unless it can be established that the surrounding structure is free of projections or other design features likely to contribute to rupture of the tank;

(5) the tank shall drop freely and impact in a horizontal position $\pm 10^{\circ}$;

(6) after the drop test, there shall be no leakage;

(b) Fuel tank load factors. Except for fuel tanks located so that tank rupture with fuel release to either significant ignition sources, such as engines, heaters, and auxiliary power units, or occupants is extremely remote, each fuel tank shall be designed and installed to retain its contents under the following ultimate inertial load factors, acting alone:
(amended 1995/06/05)

(1) for fuel tanks located in the cabin:

(i) upward - 4g,

(ii) forward - 16g,

(iii) sideward - 8g, and

(iv) downward - 20g;

(2) for fuel tanks located above or behind the crew or passenger compartment that, if loosened, could injure an occupant in an emergency landing:

(i) upward - 1.5g,

(ii) forward - 8g,

(iii) sideward - 2g, and

(iv) downward - 4g;

(3) for fuel tanks located in other areas:

(i) upward - 1.5g,

(ii) forward - 4g,

(iii) sideward - 2g,

(iv) downward - 4g.

(c) Fuel line self-sealing breakaway couplings. Self-sealing breakaway couplings shall be installed unless hazardous relative motion of fuel system components to each other or to local rotorcraft structure is demonstrated to be extremely improbable or unless other means are provided. The couplings or equivalent devices shall be installed at all fuel tank-to-fuel line connections, tank-to-tank interconnects, and at other points in the fuel system where local structural deformation could lead to the release to fuel. The following shall apply:
(amended 1995/06/05)

(1) the design and construction of self-sealing breakaway couplings shall incorporate the following design features:

(i) the load necessary to separate a breakaway coupling shall be between 25 to 50 percent of the minimum ultimate failure load (ultimate strength) of the weakest component in the fluid-carrying line. The separation load shall, in no case, be less than 300 pounds, regardless of the size of the fluid line;

(ii) a breakaway coupling shall separate whenever its ultimate load (as defined in (c)(1)(i) of this section) is applied in the failure modes most likely to occur,

(iii) all breakaway couplings shall incorporate design provisions to visually ascertain that the coupling is locked together (leak-free) and is open during normal installation and service,

(iv) all breakaway couplings shall incorporate design provisions to prevent uncoupling or unintended closing due to operational shocks, vibrations, or accelerations, and

(v) no breakaway coupling design shall allow the release of fuel once the coupling has performed its intended function;

(2) all individual breakaway couplings, coupling fuel feed systems, or equivalent means shall be designed, tested, installed and maintained so that inadvertent fuel shut-off in flight is improbable in accordance with section 529.955 (a) and shall comply with the fatigue evaluation requirements of section 529.571 without leaking;

(3) alternate, equivalent means to the use of breakaway couplings shall not create a survivable impact-induced load on the fuel line to which it is installed greater than 25 to 50 percent of the ultimate load (strength) of the weakest component in the line and shall comply with the fatigue requirements of section 529.571 without leaking.

(d) Frangible or deformable structural attachments. Unless hazardous relative motion of fuel tanks and fuel system components to local rotorcraft structure is demonstrated to be extremely improbable in an otherwise survivable impact, frangible or locally deformable attachments of fuel tanks and fuel system components to local rotorcraft structure shall be used. The attachment of fuel tanks and fuel system components to local rotorcraft structure, whether frangible or locally deformable, shall be designed such that its separation or relative local deformation will occur without rupture or local tear-out of the fuel tank or fuel system components that will cause fuel leakage. The

ultimate strength of frangible or deformable attachments shall be as follows:
(amended 1995/06/05)

(1) the load required to separate a frangible attachment from its support structure, or deform a locally deformable attachment relative to its support structure, shall be between 25 and 50 percent of the minimum ultimate load (ultimate strength) of the weakest component in the attached system. In every case the load shall not be less than 300 pounds;

(2) a frangible or locally deformable attachment shall separate or locally deform as intended whenever its ultimate load (as defined in (d)(1) of this section) is applied in the modes most likely to occur; and

(3) all frangible or locally deformable attachments shall comply with the fatigue requirements of section 529.571.

(e) Separation of fuel and ignition sources. To provide maximum crash resistance, fuel shall be located as far as practicable from any area or compartment which can be used by occupants and from all potential ignition sources.
(amended 1995/06/05)

(f) Other basic mechanical design criteria. Fuel tanks, fuel lines, electrical wires and electrical devices shall be designed, constructed and installed as far as practicable, to be crash resistant.
(amended 1995/06/05)

(g) Rigid or semi-rigid fuel tanks. Rigid or semi-rigid fuel tank or bladder walls shall be impact and tear resistant.
(amended 1995/06/05)

(h) Removed.
(amended 1995/06/05)

529.953 Fuel System Independence

(a) For category A rotorcraft, the following apply:

(1) the fuel system shall meet the requirements of section 529.903 (b); and

(2) unless other provisions are made to meet (a)(1) of this section, the fuel system shall allow fuel to be supplied to each engine through a system independent of those parts of each system supplying fuel to other engines.

(b) Each fuel system for a multi-engine category B rotorcraft shall meet the requirements of (a)(2) of this section. However, separate fuel tanks need not be provided for each engine.

529.954 Fuel System Lightning Protection

The fuel system shall be designed and arranged to prevent the ignition of fuel vapour within the system by:

(a) direct lightning strikes to areas having a high probability of stroke attachment:

(b) swept lightning strokes to areas where swept strokes are highly probable; and

(c) corona and streamering at fuel vent outlets.

529.955 Fuel Flow

(a) General. The fuel system for each engine shall provide the engine with at least 100 percent of the fuel required under all operating and manoeuvring conditions to be approved for the rotorcraft, including, as applicable, the fuel required to operate the engines under the test conditions required by section 529.927. Unless equivalent methods are used, compliance shall be demonstrated by test during which the following provisions shall be met, except those combinations of conditions which are demonstrated to be improbable need not be considered:

(1) the fuel pressure, corrected for accelerations (load factors), shall be within the limits specified by the engine type certificate data sheet;

(2) the fuel level in the tank shall not exceed that established as the unuseable fuel supply for that tank under section 529.959, plus that necessary to conduct the test;

(3) the fuel head between the tank and the engine shall be critical with respect to rotorcraft flight attitudes;

(4) the fuel flow transmitter, if installed, and the critical fuel pump (for pump-fed systems) shall be installed to produce (by actual or simulated failure) the critical restriction to fuel flow to be expected from component failure;

(5) critical values of engine rotational speed, electrical power, or other sources of fuel pump motive power shall be applied;

(6) critical values of fuel properties which adversely affect fuel flow are applied during demonstrations of fuel flow capability; and

(7) the fuel filter prescribed by section 529.997 is blocked to the degree necessary to simulate the accumulation of fuel contamination required to activate the indicator as prescribed by section 529.1305 (a)(17).

(b) Fuel transfer system. If normal operation of the fuel system requires fuel to be transferred to another tank, the transfer shall occur automatically via a system, which has been demonstrated to maintain the fuel level in the receiving tank within acceptable limits during flight or surface operation of the rotorcraft.

(c) Multiple fuel tanks. If an engine can be supplied with fuel from more than one tank, the fuel system, in addition to having appropriate manual switching capability, shall be designed to prevent interruption of fuel flow to that engine, without attention by the flight crew, when any tank supplying fuel to that engine is depleted of useable fuel during normal operation and any other tank that normally supplies fuel to that engine alone contains useable fuel.

529.956 Reserved

529.957 Flow Between Interconnected Tanks

(a) Where tank outlets are interconnected and allow fuel to flow between them due to gravity or flight accelerations, it shall be impossible for fuel to flow between tanks in quantities great enough to cause overflow from the tank vent in any sustained flight condition.

(b) If fuel can be pumped from one tank to another in flight, the following shall apply:

(1) the design of the vents and the fuel transfer system shall prevent structural damage to tanks from overfilling; and

(2) there shall be means to warn the crew before overflow through the vents occurs.

529.958 Reserved

529.959 Unuseable Fuel Supply

The unuseable fuel supply for each tank shall be established as not less than the quantity at which the first evidence of malfunction occurs under the most adverse fuel feed condition occurring under any intended operations and flight manoeuvres involving that tank.

529.960 Reserved

529.961 Fuel System Hot Weather Operation

Each suction lift fuel system and other fuel systems conducive to vapour formation shall be demonstrated to operate satisfactorily (within certification limits) when using fuel at the most critical temperature for vapour formation under critical operating conditions including, if applicable, the engine operating conditions prescribed by section 529.927 (b)(1) and (b)(2).

529.962 Reserved

529.963 Fuel Tanks: General

(a) Each fuel tank shall be able to withstand, without failure, the vibration, inertia, fluid and structural loads to which it may be subjected in operation.

(b) Each flexible fuel tank bladder or liner shall be approved or demonstrated to be suitable for the particular application and shall be puncture resistant. Puncture resistance shall be demonstrated by meeting the TSO-C80, paragraph 16.0, requirements using a minimum puncture force of 370 pounds.
(amended 1995/06/05)

(c) Each integral fuel tank shall have facilities for inspection and repair of its interior.
(amended 1995/06/05)

(d) The maximum exposed surface temperature of all components in the fuel tank shall be less by a safe margin than the lowest expected auto-ignition temperature of the fuel or fuel vapour in the tank. Compliance with this requirement shall be demonstrated under all operating conditions and under all normal or malfunction conditions of all components inside the tank.
(amended 1995/06/05)

(e) Each fuel tank installed in personnel compartments shall be isolated by fume-proof and fuel-proof enclosures that are drained and vented to the exterior of the rotorcraft. The design and construction of the enclosures shall provide necessary protection for the tank, shall be crash resistant during a survivable impact in accordance with section 529.952 and shall be adequate to withstand loads and abrasions to be expected in personnel compartments.
(amended 1995/06/05)

529.964 Reserved

529.965 Fuel Tank Tests

(a) Each fuel tank shall be able to withstand the applicable pressure tests prescribed in this section without failure or leakage. If practicable, test pressures may be applied in a manner simulating the pressure distribution in service.

(b) Each conventional metal tank, each non-metallic tank with walls that are not supported by the rotorcraft structure, and each integral tank shall be subjected to a pressure of 3.5 p.s.i. unless the pressure developed during maximum limit acceleration or emergency deceleration with a full tank exceeds this value, in which case a hydrostatic head, or equivalent test, shall be applied to duplicate the acceleration loads as far as possible. However, the pressure need not exceed 3.5 p.s.i. on surfaces not exposed to the acceleration loading.

(c) Each non-metallic tank with walls supported by the rotorcraft structure shall be subjected to the following tests:

(1) a pressure test of at least 2.0 p.s.i.. This test may be conducted on the tank alone in conjunction with the test specified in (c)(2) of this section; and

(2) a pressure test, with the tank mounted in the rotorcraft structure, equal to the load developed by the reaction of the contents, with the tank full, during maximum limit acceleration or emergency deceleration. However, the pressure need not exceed 2.0 p.s.i. on surfaces not exposed to the acceleration loading;

(d) Each tank with large unsupported or unstiffened flat areas, or with other features whose failure or deformation could cause leakage, shall be subjected to the following test or its equivalent:

(1) each complete tank assembly and its supports shall be vibration tested while mounted to simulate the actual installation;

(2) the tank assembly shall be vibrated for 25 hours while two thirds full of any suitable fluid. The amplitude of vibration shall not be less than one thirty-second of an inch unless otherwise substantiated;

(3) the test frequency of vibration shall be as follows:

(i) if no frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, the test frequency of vibration, in number of cycles per minute, shall, unless a frequency based on a more rational analysis is used, be the number obtained by averaging the maximum and minimum power-on engine speeds (r.p.m.) for reciprocating engine powered rotorcraft or 2,000 c.p.m. for turbine engine powered rotorcraft,

(ii) if only one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, that frequency of vibration shall be the test frequency, and

(iii) if more than one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, the most critical of these frequencies shall be the test frequency;

(4) under (d)(3) (ii) and (iii) of this section, the time of test shall be adjusted to accomplish the same number of vibration cycles as would be accomplished in 25 hours at the frequency specified in (d)(3)(i) of this section;

(5) during the test, the tank assembly shall be rocked at the rate of 16 to 20 complete cycles per minute through an angle of 15° on both sides of the horizontal (30° total), about the most critical axis, for 25 hours. If motion about more than one axis is likely to be critical, the tank shall be rocked about each critical axis for 12 hours 30 minutes.

529.966 Reserved

529.967 Fuel Tank Installation

(a) Each fuel tank shall be supported so that tank loads are not concentrated on unsupported tank surfaces. In addition:

(1) there shall be pads, if necessary, to prevent chafing between each tank and its supports;

(2) the padding shall be non-absorbent or treated to prevent the absorption of fuel;

(3) if flexible tank liners are used, they shall be supported so that they are not required to withstand fluid loads; and

(4) each interior surface of tank compartments shall be smooth and free of projections that could cause wear of the liner, unless:

(i) there are means for protection of the liner at those points, or

(ii) the construction of the liner itself provides such protection.

(b) Any spaces adjacent to tank surfaces shall be adequately ventilated to avoid accumulation of fuel or fumes in those spaces due to minor leakage. If the tank is in a sealed compartment, ventilation may be limited to drain holes that prevent clogging and that prevent excessive pressure resulting from altitude changes. If flexible tank liners are installed, the venting arrangement for the spaces between the liner and its container shall maintain the proper relationship to tank vent pressures for any expected flight condition.

(c) The location of each tank shall meet the requirements of section 529.1185 (b) and (c).

(d) No rotorcraft skin immediately adjacent to a major air outlet from the engine compartment shall act as the wall of an integral tank.

(e) Removed.
(amended 1995/06/05)

529.968 Reserved

529.969 Fuel Tank Expansion Space

Each fuel tank or each group of fuel tanks with interconnected vent systems shall have an expansion space of not less than 2 percent of the combined tank capacity. It shall be impossible to fill the fuel tank expansion space inadvertently with the rotorcraft in the normal ground attitude.

529.970 Reserved

529.971 Fuel Tank Sump

(a) Each fuel tank shall have a sump with a capacity of not less than the greater of:

(1) 0.10 percent of the tank capacity; or

(2) one-sixteenth gallon.

(b) The capacity prescribed in (a) of this section shall be effective with the rotorcraft in any normal attitude, and shall be located so that the sump contents cannot escape through the tank outlet opening.

(c) Each fuel tank shall allow drainage of hazardous quantities of water from each part of the tank to the sump with the rotorcraft in any ground attitude to be expected in service.

(d) Each fuel tank sump shall have a drain that allows complete drainage of the sump on the ground.

529.972 Reserved

529.973 Fuel Tank Filler Connection

(a) Each fuel tank filler connection shall prevent the entrance of fuel into any part of the rotorcraft other than the tank itself during normal operations and shall be crash resistant during a survivable impact in accordance with section 529.952 (c). In addition, the following apply:
(amended 1995/06/05)

(1) each filler shall be marked as prescribed in section 529.1557 (c)(1);

(2) each recessed filler connection that can retain any appreciable quantity of fuel shall have a drain that discharges clear of the entire rotorcraft; and

(3) each filler cap shall provide a fuel-tight seal under the fluid pressure expected in normal operation and in a survivable impact.

(b) Each filler cap or filler cap cover shall warn when the cap is not fully locked or seated on the filler connection.
(amended 1995/06/05)

529.974 Reserved

529.975 Fuel Tank Vents and Carburetor Vapour Vents

(a) Fuel tank vents. Each fuel tank shall be vented from the top part of the expansion space so that venting is effective under normal flight conditions. In addition:

(1) the vents shall be arranged to avoid stoppage by dirt or ice formation;

(2) the vent arrangement shall prevent siphoning of fuel during normal operation;

(3) the venting capacity and vent pressure levels shall maintain acceptable differences of pressure between the interior and exterior of the tank, during:

(i) normal flight operation,

(ii) maximum rate of ascent and descent, and

(iii) refuelling and defuelling (where applicable);

(4) airspaces of tanks with inter-connected outlets shall be inter-connected;

(5) there shall be no point in any vent line where moisture can accumulate with the rotorcraft in the ground attitude or the level flight attitude, unless drainage is provided;

(6) no vent or drainage provision shall end at any point:

(i) where the discharge of fuel from the vent outlet would constitute a fire hazard, or

(ii) from which fumes could enter personnel compartments; and

(7) The venting system shall be designed to minimize spillage of fuel through the vents to an ignition source in the event of a rollover during landing, ground operations or a survivable impact.
(amended 1998/11/23)

***Information Note**: At Change 529-3, (a)(7) contained a variation, which is now superseded. Refer to the information on FAR Amendment 29-35 and 29-42.*

(b) Carburetor vapour vents. Each carburetor with vapour elimination connections shall have a line to lead vapours back to one of the fuel tanks. In addition:

(1) each vent system shall have means to avoid stoppage by ice; and

(2) if there is more than one fuel tank, and it is necessary to use the tanks in a definite sequence, each vapour vent return line shall lead back to the fuel tank used for take-off and landing.

529.976 Reserved

529.977 Fuel Tank Outlet

(a) There shall be a fuel strainer for the fuel tank outlet or for the booster pump. This strainer shall:

(1) for reciprocating engine powered aeroplanes, have 8 to 16 meshes per inch;

(2) for turbine engine powered aeroplanes, prevent the passage of any object that could restrict fuel flow or damage any fuel system component.

(b) The clear area of each fuel tank outlet strainer shall be at least five times the area of the outlet line.

(c) The diameter of each strainer shall be at least that of the fuel tank outlet.

(d) Each finger strainer shall be accessible for inspection and cleaning.

529.978 Reserved

529.979 Pressure Refuelling and Fuelling Provisions Below Fuel Level

(a) Each fuelling connection below the fuel level in each tank shall have means to prevent the escape of hazardous quantities of fuel from that tank in case of malfunction of the fuel entry valve.

(b) For systems intended for pressure refuelling, a means in addition to the normal means for limiting the tank content shall be installed to prevent damage to the tank in case of failure of the normal means.

(c) The rotorcraft pressure fuelling system (not fuel tanks and fuel tank vents) shall withstand an ultimate load that is 2.0 times the load arising from the maximum pressure, including surge, that is likely to occur during fuelling. The maximum surge pressure shall be established with any combination of tank valves being either intentionally or inadvertently closed.

(d) The rotorcraft defuelling system (not including fuel tanks and fuel tank vents) shall withstand an ultimate load that is 2.0 times the load arising from the maximum permissible defuelling pressure (positive or negative) at the rotorcraft fuelling connection.

529.980 to 529.990 Reserved

Fuel System Components

529.991 Fuel Pumps

(a) Compliance with section 529.955 shall not be jeopardized by failure of:

(1) any one pump except pumps that are approved and installed as parts of a type certificated engine; or

(2) any component required for pump operation except the engine served by that pump.

(b) The following fuel pump installation requirements apply:

(1) when necessary to maintain the proper fuel pressure:

(i) a connection shall be provided to transmit the carburetor air intake static pressure to the proper fuel pump relief valve connection, and

(ii) the gauge balance lines shall be independently connected to the carburetor inlet pressure to avoid incorrect fuel pressure readings;

(2) the installation of fuel pumps having seals or diaphragms that may leak shall have means for draining leaking fuel;

(3) each drain line shall discharge where it will not create a fire hazard.

529.992 Reserved

529.993 Fuel System Lines and Fittings

(a) Each fuel line shall be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure, valve actuation, and accelerated flight conditions.

(b) Each fuel line connected to components of the rotorcraft between which relative motion could exist shall have provisions for flexibility.

(c) Each flexible connection in fuel lines that may be under pressure or subjected to axial loading shall use flexible hose assemblies.

(d) Flexible hose shall be approved.

(e) No flexible hose that might be adversely affected by high temperatures shall be used where excessive temperatures will exist during operation or after engine shutdown.

529.994 Reserved

529.995 Fuel Valves

In addition to meeting the requirements of section 529.1189, each fuel valve shall:

(a) Reserved;

(b) be supported so that no loads resulting from their operation or from accelerated flight conditions are transmitted to the lines attached to the valve.

529.996 Reserved

529.997 Fuel Strainer or Filter

There shall be a fuel strainer or filter between the fuel tank outlet and the inlet of the first fuel system component which is susceptible to fuel contamination, including but not limited to the fuel metering device or an engine positive displacement pump, whichever is nearer the fuel tank outlet. This fuel strainer or filter shall:

(a) be accessible for draining and cleaning and shall incorporate a screen or element which is easily removable;

(b) have a sediment trap and drain, except that it need not have a drain if the strainer or filter is easily removable for drain purpose;

(c) be mounted so that its weight is not supported by the connecting lines or by the inlet or outlet connections of the strainer or filter itself, unless adequate strength margins under all loading conditions are provided in the lines and connections; and

(d) provide a means to remove from the fuel any contaminant which would jeopardize the flow of fuel through rotorcraft or engine fuel system components required for proper rotorcraft or engine fuel system operation.

529.998 Reserved

529.999 Fuel System Drains

(a) There shall be at least one accessible drain at the lowest point in each fuel system to completely drain the system with the rotorcraft in any ground attitude to be expected in service.

(b) Each drain required by (a) of this section including the drains prescribed in section 529.971 shall:

(1) discharge clear of all parts of the rotorcraft;

(2) have manual or automatic means to ensure positive closure in the off position; and

(3) have a drain valve:

(i) that is readily accessible and which can be easily opened and closed, and

(ii) that is either located or protected to prevent fuel spillage in the event of a landing with landing gear retracted.

529.1000 Reserved

529.1001 Fuel Jettisoning

If a fuel jettisoning system is installed, the following apply:

(a) fuel jettisoning shall be safe during all flight regimes for which jettisoning is to be authorized;

(b) in demonstrating compliance with (a) of this section, it shall be demonstrated that:

(1) the fuel jettisoning system and its operation are free from fire hazard;

(2) no hazard results from fuel or fuel vapours which impinge on any part of the rotorcraft during fuel jettisoning; and

(3) controllability of the rotorcraft remains satisfactory throughout the fuel jettisoning operation;

(c) means shall be provided to automatically prevent jettisoning fuel below the level required for an all-engine climb at maximum continuous power from sea level to 5,000 feet altitude and cruise thereafter for 30 minutes at maximum range engine power;

(d) the controls for any fuel jettisoning system shall be designed to allow flight personnel (minimum crew) to safely interrupt fuel jettisoning during any part of the jettisoning operation;

(e) the fuel jettisoning system shall be designed to comply with the powerplant installation requirements of section 529.901 (c);

(f) an auxiliary fuel jettisoning system which meets the requirements of (a), (b), (d) and (e) of this section may be installed to jettison additional fuel provided it has separate and independent controls.

529.1002 to 529.1010 Reserved

Oil System

529.1011 Engines: General

(a) Each engine shall have an independent oil system that can supply it with an

appropriate quantity of oil at a temperature not above that safe for continuous operation.

(b) The useable oil capacity of each system shall not be less than the product of the endurance of the rotorcraft under critical operating conditions and the maximum allowable oil consumption of the engine under the same conditions, plus a suitable margin to ensure adequate circulation and cooling. Instead of a rational analysis of endurance and consumption, a useable oil capacity of one gallon for each 40 gallons of useable fuel may be used for reciprocating engine installations.

(c) Oil-fuel ratios lower than those prescribed in (b) of this section may be used if they are substantiated by data on the oil consumption of the engine.

(d) The ability of the engine oil cooling provisions to maintain the oil temperature at or below the maximum established value shall be demonstrated under the applicable requirements of sections 529.1041 through 529.1049.

529.1012 Reserved

529.1013 Oil Tanks

(a) Installation. Each oil tank installation shall meet the requirements of section 529.967.

(b) Expansion space. Oil tank expansion space shall be provided so that:

(1) each oil tank used with a reciprocating engine has an expansion space of not less than the greater of 10 percent of the tank capacity or 0.5 gallons, and each oil tank used with a turbine engine has an expansion space of not less than 10 percent of the tank capacity;

(2) each reserve oil tank not directly connected to any engine has an expansion space of not less than 2 percent of the tank capacity; and

(3) it is impossible to fill the expansion space inadvertently with the rotorcraft in the normal ground attitude.

(c) Filler connection. Each recessed oil tank filler connection that can retain any appreciable quantity of oil shall have a drain that discharges clear of the entire rotorcraft. In addition:

(1) each oil tank filler cap shall provide an oil-tight seal under the pressure expected in operation;

(2) for category A rotorcraft, each oil tank filler cap or filler cap cover shall incorporate features that provide a warning when caps are not fully locked or seated on the filler connection; and

(3) each oil filler shall be marked under section 529.1557 (c)(2).

(d) Vent. Oil tanks shall be vented as follows:

(1) each oil tank shall be vented from the top part of the expansion space so that venting is effective under all normal flight conditions;

(2) oil tank vents shall be arranged so that condensed water vapour that might freeze and obstruct the line cannot accumulate at any point.

(e) Outlet. There shall be means to prevent entrance into the tank itself, or into the tank outlet, of any object that might obstruct the flow of oil through the system. No oil tank outlet shall be enclosed by a screen or guard that would reduce the flow of oil below a safe value at any operating temperature. There shall be a shut-off valve at the outlet of each oil tank used with a turbine engine unless the external portion of the oil system (including oil tank supports) is fireproof.

(f) Flexible liners. Each flexible oil tank liner shall be approved or demonstrated to be suitable for the particular installation.

529.1014 Reserved

529.1015 Oil Tank Tests

Each oil tank shall be designed and installed so that:

(a) it can withstand, without failure, any vibration, inertia and fluid loads to which it may be subjected in operation; and

(b) it meets the requirements of section 529.965, except that instead of the pressure specified in section 529.965 (b):

(1) for pressurized tanks used with a turbine engine, the test pressure shall not be less than 5 p.s.i. plus the maximum operating pressure of the tank;

(2) for all other tanks, the test pressure shall not be less than 5 p.s.i..

529.1016 Reserved

529.1017 Oil Lines and Fittings

(a) Each oil line shall meet the requirements of section 529.993.

(b) Breather lines shall be arranged so that:

(1) condensed water vapour that might freeze and obstruct the line cannot accumulate at any point;

(2) the breather discharge will not constitute a fire hazard if foaming occurs, or cause emitted oil to strike the pilot's windshield; and

(3) the breather does not discharge into the engine air induction system.

529.1018 Reserved

529.1019 Oil Strainer or Filter

(a) Each turbine engine installation shall incorporate an oil strainer or filter through which all of the engine oil flows and which meets the following requirements:

(1) each oil strainer or filter that has a bypass shall be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter completely blocked;

(2) the oil strainer or filter shall have the capacity (with respect to operating limitation established for the engine) to ensure that engine oil system functioning is not impaired when the oil is contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine under Chapter 533 of this Manual;

(3) the oil strainer or filter, unless it is installed at an oil tank outlet, shall incorporate a means to indicate contamination before it reaches the capacity established in accordance with (a)(2) of this section;

(4) the bypass of a strainer or filter shall be constructed and installed so that the release of collected contaminants is minimized by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path; and

(5) an oil strainer or filter that has no bypass, except one that is installed at an oil tank outlet, shall have a means to connect it to the warning system required in section 529.1305 (a)(18).

(b) Each oil strainer or filter in a powerplant installation using reciprocating engines shall be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter element completely blocked.

529.1020 Reserved

529.1021 Oil System Drains

A drain (or drains) shall be provided to allow safe drainage of the oil system. Each drain shall:

(a) be accessible; and

(b) have manual or automatic means for positive locking in the closed position.

529.1022 Reserved

529.1023 Oil Radiators

(a) Each oil radiator shall be able to withstand any vibration, inertia, and oil pressure loads to which it would be subjected in operation.

(b) Each oil radiator air duct shall be located, or equipped, so that, in case of fire, and with the airflow as it would be with and without the engine operating, flames cannot directly strike the radiator.

529.1024 Reserved

529.1025 Oil Valves

(a) Each oil shut-off shall meet the requirements of section 529.1189.

(b) The closing of oil shut-offs shall not prevent autorotation.

(c) Each oil valve shall have positive stops or suitable index provisions in the "on" and "off" positions and shall be supported so that no loads resulting from its operation or from accelerated flight conditions are transmitted to the lines attached to the valve.

529.1026 Reserved

529.1027 Transmission and Gear Boxes: General

(a) The oil system for components of the rotor drive system that require continuous lubrication shall be sufficiently independent of the lubrication systems of the engines to ensure:

(1) operation with any engine inoperative; and

(2) safe autorotation.

(b) Pressure lubrication systems for transmissions and gearboxes shall comply with the requirements of (c), (d) and (f) of section 529.1013, sections 529.1015, 529.1017, 529.1021, 529.1023, and 529.1337(d). In addition, the system shall have:

(1) an oil strainer or filter through which all the lubricant flows, and shall:

(i) be designed to remove from the lubricant any contaminant which may damage transmission and drive system components or impede the flow of lubricant to a hazardous degree, and

(ii) be equipped with a bypass constructed and installed so that:

(A) the lubricant will flow at the normal rate through the rest of the system with the strainer or filter completely blocked, and

(B) the release of collected contaminants is minimized by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path,

(iii) be equipped with a means to indicate collection of contaminants on the filter or strainer at or before opening of the bypass;

(2) for each lubricant tank or sump outlet supplying lubrication to rotor drive

systems and rotor drive system components, a screen to prevent entrance into the lubrication system of any object that might obstruct the flow of lubricant from the outlet to the filter required by (b)(1) of this section. The requirements of (b)(1) of this section do not apply to screens installed at lubricant tank or sump outlets.

(c) Splash type lubrication systems for rotor drive system gearboxes shall comply with sections 529.1021 and 529.1337 (d).

529.1028 to 529.1040 Reserved

Cooling

529.1041 General

(a) The powerplant and auxiliary power unit cooling provisions shall be able to maintain the temperatures of powerplant components, engine fluids, and auxiliary power unit components and fluids within the temperature limits established for these components and fluids, underground, water, and flight operating conditions for which certification is requested, and after normal engine or auxiliary power shutdown, or both.

(b) There shall be cooling provisions to maintain the fluid temperatures in any power transmission within safe values under any critical surface (ground or water) and flight operating conditions.

(c) Except for ground-use-only auxiliary power units, compliance with (a) and (b) of this section shall be demonstrated by flight tests in which the temperatures of selected powerplant component and auxiliary power unit component, engine, and transmission fluids are obtained under the conditions prescribed in (a) and (b) of this section.

529.1042 Reserved

529.1043 Cooling Tests

(a) General. For the tests prescribed in section 529.1041 (c), the following apply:

(1) if the tests are conducted under conditions deviating from the maximum ambient atmospheric temperature specified in (b) of this section, the recorded powerplant temperatures shall be corrected under (c) and (d) of this section, unless a more rational correction method is applicable;

(2) no corrected temperature determined under (a)(1) of this section shall exceed established limits;

(3) the fuel used during the cooling tests shall be of the minimum grade approved for the engines, and the mixture settings shall be those used in normal operation;

(4) the test procedures shall be as prescribed in sections 529.1045 through 529.1049; and

(5) for the purpose of the cooling tests, a temperature is "stabilized" when its rate of change is less than 2°F per minute.

(b) Maximum ambient atmospheric temperature. A maximum ambient atmospheric temperature corresponding to sea level conditions of at least 100 degrees F shall be established. The assumed temperature lapse rate is 3.6 degrees F per thousand feet of altitude above sea level until a temperature of -69.7 degrees F is reached, above which altitude the temperature is considered constant at -69.7 degrees F. However, for winterization installations, the applicant may select a maximum ambient atmospheric temperature corresponding to sea level conditions of less than 100 degrees F.

(c) Correction factor (except cylinder barrels). Unless a more rational correction applies, temperatures of engine fluids and powerplant components (except cylinder barrels) for which temperature limits are established, shall be corrected by adding to them the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum component or fluid temperature recording during the cooling test.

(d) Correction factor for cylinder barrel temperatures. Cylinder barrel temperatures shall be corrected by adding to them 0.7 times the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test.

529.1044 Reserved

529.1045 Climb Cooling Test Procedures

(a) Climb cooling tests shall be conducted under this section for:

(1) category A rotorcraft; and

(2) multi-engine category B rotorcraft for which certification is requested under the category A powerplant installation requirements, and under the requirements of section 529.861 (a), at the steady rate of climb or descent established under section 529.67 (b).

(b) The climb or descent cooling tests shall be conducted with the engine inoperative that produces the most adverse cooling conditions for the remaining engines and powerplant components.

(c) Each operating engine shall:

(1) for helicopters for which the use of 30 minute-OEI power is requested, be at 30 minute-OEI power for 30 minutes, and then at maximum continuous power (or at full throttle, when above the critical altitude);

(2) for helicopters for which the use of continuous OEI power is requested, be at continuous OEI power (or at full throttle when above the critical altitude); and

(3) for other rotorcraft, be at maximum continuous power (or at full throttle, when above the critical altitude).

(d) After temperatures have stabilized in flight, the climb shall:

(1) begun from an altitude not greater than the lower of:

(i) 1,000 feet below the engine critical altitude, and

(ii) 1,000 feet below the maximum altitude at which the rate of climb is 150 f.p.m; and

(2) be continued for at least 5 minutes after the occurrence of the highest temperature recorded, or until the rotorcraft reaches the maximum altitude for which certification is requested.

(e) For category B rotorcraft without a positive rate of climb, the descent shall begin at the all-engine-critical altitude and end at the higher of:

(1) the maximum altitude at which level flight can be maintained with one engine operative; and

(2) sea level.

(f) The climb or descent shall be conducted at an airspeed representing a normal operational practice for the configuration being tested. However, if the cooling provisions are sensitive to rotorcraft speed, the most critical airspeed shall be used, but need not exceed the speeds established under section 529.67 (a)(2) or 529.67 (b). The climb cooling test may be conducted in conjunction with the take-off cooling test prescribed at section 529.1047.

529.1046 Reserved

529.1047 Take-off Cooling Test Procedures

(a) Category A. For each category A rotorcraft, cooling shall be demonstrated during takeoff and subsequent climb as follows:

(1) each temperature shall be stabilized while hovering in ground effect with:

(i) the power necessary for hovering,

(ii) the appropriate cowl flap and shutter settings, and

(iii) the maximum weight;

(2) after the temperatures have stabilized, a climb shall be started at the lowest practicable altitude and shall be conducted with one engine inoperative;

(3) the operating engines shall be at the greatest power for which approval is sought (or at full throttle when above the critical altitude) for the same period as this power is used in determining the take-off climb-out path under section 529.59;

(4) at the end of the time interval prescribed in (a)(3) of this section, the power shall

be changed to that used in meeting section 529.67 (a)(2) and the climb shall be continued for:

(i) thirty minutes, if 30 minute-OEI power is used, or

(ii) at least 5 minutes after the occurrence of the highest temperature recorded, if continuous OEI power or maximum continuous power is used; and

(5) the speeds shall be those used in determining the take-off flight path under section 529.59.

(b) Category B. For each category B rotorcraft, cooling shall be demonstrated during takeoff and subsequent climb as follows:

(1) each temperature shall be stabilized while hovering in ground effect with:

(i) the power necessary for hovering,

(ii) the appropriate cowl flap and shutter settings, and

(iii) the maximum weight;

(2) after the temperatures have stabilized, a climb shall be started at the lowest practicable altitude with take-off power;

(3) take-off power shall be used for the same time interval as take-off power is used in determining the take-off flight path under section 529.63;

(4) at the end of the time interval prescribed in (b)(3) of this section, the power shall be reduced to maximum continuous power and the climb shall be continued for at least 5 minutes after the occurrence of the highest temperature recorded; and

(5) the cooling test shall be conducted at an airspeed corresponding to normal operating practice for the configuration being tested. However, if the cooling provisions are sensitive to rotorcraft speed, the most critical airspeed shall be used, but need not exceed the speed for best rate of climb with maximum continuous power.

529.1048 Reserved

529.1049 Hovering Cooling Test Procedures

The hovering cooling provisions shall be demonstrated:

(a) at maximum weight or at the greatest weight at which the rotorcraft can hover (if less), at sea level, with the power required to hover but not more than maximum continuous power, in the ground effect in still air, until at least 5 minutes after the occurrence of the highest temperature recorded; and

(b) with maximum continuous power, maximum weight, and at the altitude resulting in zero rate of climb for this configuration, until at least 5 minutes after the occurrence of the highest temperature recorded.

529.1050 to 529.1090 Reserved

Induction System

529.1091 Air Induction

(a) The air induction system for each engine and auxiliary power unit shall supply the air required by that engine and auxiliary power unit under the operating conditions for which certification is requested.

(b) Each engine and auxiliary power unit air induction system shall provide air for proper fuel metering and mixture distribution with the induction system valves in any position.

(c) No air intake shall open within the engine accessory section or within other areas of any powerplant compartment where emergence of backfire flame would constitute a fire hazard.

(d) Each reciprocating engine shall have an alternate air source.

(e) Each alternate air intake shall be located to prevent the entrance of rain, ice, or other foreign matter.

(f) For turbine engine powered rotorcraft and rotorcraft incorporating auxiliary power units:

(1) there shall be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine or auxiliary power unit intake system; and

(2) the air ducts shall be located or protected so as to minimize the ingestion of foreign matter during takeoff, landing, and taxiing.

529.1092 Reserved

529.1093 Induction System Icing Protection

(a) Reciprocating engines. Each reciprocating engine air induction system shall have means to prevent and eliminate icing. Unless this is done by other means, the following shall be demonstrated in air free of visible moisture at a temperature of 30°F, and with the engines at 60 percent of maximum continuous power:

(1) each rotorcraft with sea level engines using conventional venturi carburetors has a preheater that can provide a heat rise of 90°F;

(2) each rotorcraft with sea level engines using carburetors tending to prevent icing has a preheater that can provide a heat rise of 70°F;

(3) each rotorcraft with altitude engines using conventional venturi carburetors has a preheater that can provide a heat rise of 120° F; and

(4) each rotorcraft with altitude engines using carburetors tending to prevent icing

has a preheater that can provide a heat rise of 100°F.

(b) Turbine engines.

(1) it shall be demonstrated that each turbine engine and its air inlet system can operate throughout the flight power range of the engine (including idling):

(i) without accumulating ice on engine or inlet system components that would adversely affect engine operation or cause a serious loss of power under the icing conditions specified in Appendix C of this Chapter, and

(ii) in falling, blowing, and recirculating snow without adverse effect on engine operation, or

***Information Note**: FAR: (ii) In snow, both falling and blowing, without adverse effect on engine operation, within the limitations established for the rotorcraft.*

(iii) if certification for flight in snow has not been requested, the engine tolerance to snow shall be demonstrated;
(amended 2003/12/01)

***Information Note**: There is no equivalent text in the FAR.*

(2) each turbine engine shall idle for 30 minutes on the ground, with the air bleed available for engine icing protection at its critical condition, without adverse effect, in an atmosphere that is at a temperature between 15° and 30°F (between -9° and -1°C) and has a liquid water content not less than 0.3 grams per cubic metre in the form of drops having a mean effective diameter not less than 20 microns, followed by a momentary operation at take-off power or thrust. During the 30 minutes of idle operation, the engine may be run up periodically to a moderate power or thrust setting in a manner acceptable to the Minister.

(c) Supercharged reciprocating engines. For each engine having a supercharger to pressurize the air before it enters the carburetor, the heat rise in the air caused by that supercharging at any altitude may be utilized in determining compliance with (a) of this section if the heat rise utilized is that which will be available, automatically, for the applicable altitude and operation condition because of supercharging.

529.1094 to 529.1100 Reserved

529.1101 Carburetor Air Preheater Design

Each carburetor air preheater shall be designed and constructed to:

(a) ensure ventilation of the preheater when the engine is operated in cold air;

(b) allow inspection of the exhaust manifold parts that it surrounds; and

(c) allow inspection of critical parts of the preheater itself.

529.1102 Reserved

529.1103 Induction Systems Ducts and Air Duct Systems

(a) Each induction system duct upstream of the first stage of the engine supercharger and of the auxiliary power unit compressor shall have a drain to prevent the hazardous accumulation of fuel and moisture in the ground attitude. No drain shall discharge where it might cause a fire hazard.

(b) Each duct shall be strong enough to prevent induction system failure from normal backfire conditions.

(c) Each duct connected to components between which relative motion could exist shall have means for flexibility.

(d) Each duct within any fire zone for which a fire-extinguishing system is required shall be at least:

(1) fireproof, if it passes through any firewall; or

(2) fire resistant, for other ducts, except that ducts for auxiliary power units shall be fireproof within the auxiliary power unit fire zone.

(e) Each auxiliary power unit induction system duct shall be fireproof for a sufficient distance upstream of the auxiliary power unit compartment to prevent hot gas reverse flow from burning through auxiliary power unit ducts and entering any other compartment or area of the rotorcraft in which a hazard would be created resulting from the entry of hot gases. The materials used to form the remainder of the induction system duct and plenum chamber of the auxiliary power unit shall be capable of resisting the maximum heat conditions likely to occur.

(f) Each auxiliary power unit induction system duct shall be constructed of materials that will not absorb or trap hazardous quantities of flammable fluids that could be ignited in the event of a surge or reverse flow condition.

529.1104 Reserved

529.1105 Induction System Screens

If induction system screens are used:

(a) each screen shall be upstream of the carburetor;

(b) no screen shall be in any part of the induction system that is the only passage through which air can reach the engine, unless it can be de-iced by heated air;

(c) no screen shall be de-iced by alcohol alone; and

(d) it shall be impossible for fuel to strike any screen.

529.1106 Reserved

529.1107 Inter-coolers and After-coolers

Each inter-cooler and after-cooler shall be able to withstand the vibration, inertia, and air pressure loads to which it would be subjected in operation.

529.1108 Reserved

529.1109 Carburetor Air Cooling

It shall be demonstrated under section 529.1043 that each installation using two-stage superchargers has means to maintain the air temperature, at the carburetor inlet, at or below the maximum established value.

529.1110 to 529.1120 Reserved

Exhaust System

529.1121 General

For powerplant and auxiliary power unit installations the following apply:

(a) each exhaust system shall ensure safe disposal of exhaust gases without fire hazard or carbon monoxide contamination in any personnel compartment;

(b) each exhaust system part with a surface hot enough to ignite flammable fluids or vapours shall be located or shielded so that leakage from any system carrying flammable fluids or vapours will not result in a fire caused by impingement of the fluids or vapours on any part of the exhaust system including shields for the exhaust system;

(c) each component upon which hot exhaust gases could impinge, or that could be subjected to high temperatures from exhaust system parts, shall be fireproof. Each exhaust system component shall be separated by a fireproof shield from adjacent parts of the rotorcraft that are outside the engine and auxiliary power unit compartments;

(d) no exhaust gases shall discharge so as to cause a fire hazard with respect to any flammable fluid vent or drain;

(e) no exhaust gases shall discharge where they will cause a glare seriously affecting pilot vision at night;

(f) each exhaust system component shall be ventilated to prevent points of excessively high temperature;

(g) each exhaust shroud shall be ventilated or insulated to avoid, during normal operation, a temperature high enough to ignite any flammable fluids or vapours outside the shroud; and

(h) if significant traps exist, each turbine engine exhaust system shall have drains discharging clear of the rotorcraft, in any normal ground and flight attitudes, to prevent fuel accumulation after the failure of an attempted engine start.

529.1122 Reserved

529.1123 Exhaust Piping

(a) Exhaust piping shall be heat and corrosion resistant, and shall have provisions to prevent failure due to expansion by operating temperatures.

(b) Exhaust piping shall be supported to withstand any vibration and inertia loads to which it would be subjected in operation.

(c) Exhaust piping connected to components between which relative motion could exist shall have provisions for flexibility.

529.1124 Reserved

529.1125 Exhaust Heat Exchangers

For reciprocating engine powered rotorcraft the following apply:

(a) each exhaust heat exchanger shall be constructed and installed to withstand the vibration, inertia, and other loads to which it would be subjected in operation. In addition:

(1) each exchanger shall be suitable for continued operation at high temperatures and resistant to corrosion from exhaust gases;

(2) there shall be means for inspecting of the critical parts of each exchanger;

(3) each exchanger shall have cooling provisions wherever it is subject to contact with exhaust gases; and

(4) no exhaust heat exchanger or muff shall have stagnant areas or liquid traps that would increase the probability of ignition of flammable fluids or vapours that might be present in case of the failure or malfunction of components carrying flammable fluids;
(amended 1998/10/29)

(b) if an exhaust heat exchanger is used for heating ventilating air used by personnel:

(1) there shall be a secondary heat exchanger between the primary exhaust gas heat exchanger and the ventilating air system; or

(2) other means shall be used to prevent harmful contamination of the ventilating air.

529.1126 to 529.1140 Reserved

Powerplant Controls and Accessories

529.1141 Powerplant Controls: General

(a) Powerplant controls shall be located and arranged under section 529.777 and marked under section 529.1555.

(b) Each control shall be located so that it cannot be inadvertently operated by persons entering, leaving, or moving normally in, the cockpit.

(c) Each flexible powerplant control shall be approved.

(d) Each control shall be able to maintain any set position without:

(1) constant attention; or

(2) tendency to creep due to control loads or vibration.

(e) Each control shall be able to withstand operating loads without excessive deflection.

(f) Controls of powerplant valves required for safety shall have:

(1) for manual valves, positive steps or in the case of fuel valves suitable index positions, in the open and closed position; and

(2) for power-assisted valves, a means to indicate to the flight crew when the valve:

(i) is in the fully open or fully closed position, or

(ii) is moving between the fully open and fully closed position.

529.1142 Auxiliary Power Unit Controls

Means shall be provided on the flight deck for starting, stopping, and emergency shut-down of each installed auxiliary power unit.

529.1143 Engine Controls

(a) There shall be a separate power control for each engine.

(b) Power controls shall be arranged to allow ready synchronization of all engines by:

(1) separate control of each engine; and

(2) simultaneous control of all engines.

(c) Each power control shall provide a positive and immediately responsive means of controlling its engine.

(d) Each fluid injection control other than fuel system control shall be in the corresponding power control. However, the injection system pump may have a separate control.

(e) If a power control incorporates a fuel shut-off feature, the control shall have a means to prevent the inadvertent movement of the control into the shut-off position. The means shall:

(1) have a positive lock or stop at the idle position; and

(2) require a separate and distinct operation to place the control in the shut-off position.

(f) For rotorcraft to be certificated for a 30 second-OEI power rating, a means shall be provided to automatically activate and control the 30 second-OEI power and prevent any engine from exceeding the installed engine limits associated with the 30 second-OEI power rating approved for the rotorcraft.
(amended 1995/03/25)

529.1144 Reserved

529.1145 Ignition Switches

(a) Ignition switches shall control each ignition circuit on each engine.

(b) There shall be means to quickly shut off all ignition by the grouping of switches or by a master ignition control.

(c) Each group of ignition switches, except ignition switches for turbine engines for which continuous ignition is not required, and each master ignition control shall have a means to prevent its inadvertent operation.

529.1146 Reserved

529.1147 Mixture Controls

(a) If there are mixture controls, each engine shall have a separate control, and the controls shall be arranged to allow:

(1) separate control of each engine; and

(2) simultaneous control of all engines.

(b) Each intermediate position of the mixture controls that corresponds to a normal operating setting shall be identifiable by feel and sight.

529.1148 to 529.1150 Reserved

529.1151 Rotor Brake Controls

(a) It shall be impossible to apply the rotor brake inadvertently in flight.

(b) There shall be means to warn the crew if the rotor brake has not been completely released before takeoff.

529.1152 to 529.1156 Reserved

529.1157 Carburetor Air Temperature Controls

There shall be a separate carburetor air temperature control for each engine.

529.1158 Reserved

529.1159 Supercharger Controls

Each supercharger control shall be accessible to:

(a) the pilots; or

(b) if there is a separate flight engineer station with a control panel, the flight engineer.

529.1160 to 529.1162 Reserved

529.1163 Powerplant Accessories

(a) Each engine mounted accessory shall:

(1) be approved for mounting on the engine involved;

(2) use the provisions on the engine for mounting; and

(3) be sealed in such a way as to prevent contamination of the engine oil system and the accessory system.

(b) Electrical equipment subject to arcing or sparking shall be installed to minimize the probability of igniting flammable fluids or vapours.

(c) If continued rotation of an engine-driven cabin supercharger or any remote accessory driven by the engine will be a hazard if they malfunction, there shall be means to prevent their hazardous rotation without interfering with the continued operation of the engine.

(d) Unless other means are provided, torque limiting means shall be provided for accessory drives located on any component of the transmission and rotor drive system to prevent damage to these components from excessive accessory load.

529.1164 Reserved

529.1165 Engine Ignition Systems

(a) Each battery ignition system shall be supplemented with a generator that is automatically available as an alternate source of electrical energy to allow continued engine operation if any battery becomes depleted.

(b) The capacity of batteries and generators shall be large enough to meet the simultaneous demands of the engine ignition system and the greatest demands of any electrical system components that draw from the same source.

(c) The design of the engine ignition system shall account for:

(1) the condition of an inoperative generator;

(2) the condition of a completely depleted battery with the generator running at its normal operating speed; and

(3) the condition of a completely depleted battery with the generator operating at idling speed, if there is only one battery.

(d) Magneto ground wiring (for separate ignition circuits) that lies on the engine side of any firewall shall be installed, located or protected to minimize the probability of the simultaneous failure of two or more wires as a result of mechanical damage, electrical fault or other cause.

(e) No ground wire for any engine shall be routed through a fire zone of another engine unless each part of that wire within that zone is fireproof.

(f) Each ignition system shall be independent of any electrical circuit that is not used for assisting, controlling, or analysing the operation of that system.

(g) There shall be means to warn appropriate crew members if the malfunction of any part of the electrical system is causing the continuous discharge of any battery necessary for engine ignition.

529.1166 to 529.1180 Reserved

Powerplant Fire Protection

529.1181 Designated Fire Zones: Regions Included

(a) Designated fire zones are:

(1) the engine power section of reciprocating engines;

(2) the engine accessory section of reciprocating engines;

(3) any complete powerplant compartment in which there is no isolation between the engine power section and the engine accessory section, for reciprocating engines;

(4) any auxiliary power unit compartment;

(5) any fuel-burning heater and other combustion equipment installation described in section 529.859;

(6) the compressor and accessory sections of turbine engines; and

(7) the combustor, turbine, and tailpipe sections of turbine engine installations

except sections that do not contain lines and components carrying flammable fluids or gases and are isolated from the designated fire zone prescribed in (a)(6) of this section by a firewall that meets section 529.1191.

(b) Each designated fire zone shall meet the requirements of sections 529.1183 through 529.1203.

529.1182 Reserved

529.1183 Lines, Fittings, and Components

(a) Except as provided in (b) of this section, each line, fitting and other component carrying flammable fluid in any area subject to engine fire conditions and each component which conveys or contains flammable fluid in a designated fire zone shall be fire resistant, except that flammable fluid tanks and supports in a designated fire zone shall be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. Components shall be shielded or located so as to safeguard against the ignition of leaking flammable fluid. An integral oil sump of less than 25 quart (23.66 litre) capacity on a reciprocating engine need not be fireproof nor be enclosed by a fireproof shield.

(b) The requirements prescribed in (a) of this section does not apply to:

(1) lines, fittings and components which are already approved as part of a type certificated engine; and

(2) vent and drain lines, and their fittings, whose failure will not result in or add to, a fire hazard.

529.1184 Reserved

529.1185 Flammable Fluids

(a) No tank or reservoir that is part of a system containing flammable fluids or gases shall be in a designated fire zone unless the fluid contained, the design of the system, the materials used in the tank and its supports, the shut-off means, and the connections, lines and controls provide a degree of safety equal to that which would exist if the tank or reservoir were outside such a zone.

(b) Each fuel tank shall be isolated from the engines by a firewall or shroud.

(c) There shall be at least one-half inch (12.7 mm) of clear airspace between each tank or reservoir and each firewall or shroud isolating a designated fire zone, unless equivalent means are used to prevent heat transfer from the fire zone to the flammable fluid.

(d) Absorbent materials close to flammable fluid system components that might leak shall be covered or treated to prevent the absorption of hazardous quantities of fluids.

529.1186 Reserved

529.1187 Drainage and Ventilation of Fire Zones

(a) There shall be complete drainage of each part of each designated fire zone to minimize the hazards resulting from failure or malfunction of any component containing flammable fluids. The drainage means shall be:

(1) effective under conditions expected to prevail when drainage is needed; and

(2) arranged so that no discharged fluid will cause an additional fire hazard.

(b) Each designated fire zone shall be ventilated to prevent the accumulation of flammable vapours.

(c) No ventilation opening shall be where it would allow the entry of flammable fluids, vapours or flame from other zones.

(d) Ventilation means shall be arranged so that no discharged vapours will cause an additional fire hazard.

(e) For category A rotorcraft, there shall be means to allow the crew to shut off the sources of forced ventilation in any fire zone (other than the engine power section of the powerplant compartment) unless the amount of extinguishing agent and the rate of discharge are based on the maximum airflow through that zone.

529.1188 Reserved

529.1189 Shut-off Means

(a) There shall be means to shut-off or otherwise prevent hazardous quantities of fuel, oil, de-icing fluid and other flammable fluids from flowing into, within, or through any designated fire zone, except that this means need not be provided:

(1) for lines, fittings and components forming an integral part of an engine;

(2) for oil systems for turbine engine installations in which all components of the system, including oil tanks, are fireproof or located in areas not subject to engine fire conditions; or

(3) for engine oil systems in category B rotorcraft using reciprocating engines of less than 500 cubic inches (8.2 litres) displacement.

(b) The closing of any fuel shut-off valve for any engine shall not make fuel unavailable to the remaining engines.

(c) For category A rotorcraft, no hazardous quantity of flammable fluid shall drain into any designated fire zone after shut-off has been accomplished, nor shall the closing of any fuel shut-off valve for an engine make fuel unavailable to the remaining engines.

(d) The operation of any shut-off shall not interfere with the later emergency operation of any other equipment, such as the means for declutching the engine from the rotor drive.

(e) Each shut-off valve and its control shall be designed, located and protected to function properly under any condition likely to result from fire in a designated fire zone.

(f) Except for ground-use-only auxiliary power unit installations, there shall be means to prevent inadvertent operation of each shut-off and to make it possible to reopen it in flight after it has been closed.

529.1190 Reserved

529.1191 Firewalls

(a) Each engine, including the combustor, turbine and tailpipe sections of turbine engine installations, shall be isolated by a firewall, shroud or equivalent means, from personnel compartments, structures, controls, rotor mechanisms and other parts that are:

(1) essential to controlled flight and landing; and

(2) not protected under section 529.861.

(b) Each auxiliary power unit, combustion heater and other combustion equipment to be used in flight, shall be isolated from the rest of the rotorcraft by firewalls, shrouds or equivalent means.

(c) Each firewall or shroud shall be constructed so that no hazardous quantity of air, fluid or flame can pass from any engine compartment to other parts of the rotorcraft.

(d) Each opening in the firewall or shroud shall be sealed with close-fitting fireproof grommets, bushings or firewall fittings.

(e) Each firewall and shroud shall be fireproof and protected against corrosion.

(f) In meeting this section, account shall be taken of the probable path of a fire as affected by the airflow in normal flight and in autorotation.

529.1192 Reserved

529.1193 Cowling and Engine Compartment Covering

(a) Each cowling and engine compartment covering shall be constructed and supported so that it can resist the vibration, inertia and air loads to which it may be subjected in operation.

(b) Cowling shall meet the drainage and ventilation requirements of section 529.1187.

(c) On rotorcraft with a diaphragm isolating the engine power section from the engine accessory section, each part of the accessory section cowling subject to flame in case of fire in the engine power section of the powerplant shall:

(1) be fireproof; and

(2) meet the requirements of section 529.1191.

(d) Each part of the cowling or engine compartment covering subject to high temperatures due to its nearness to exhaust system parts or exhaust gas impingement shall be fireproof.

(e) Each rotorcraft shall:

(1) be designed and constructed so that no fire originating in any fire zone can enter, either through openings or by burning through external skin, any other zone or region where it would create additional hazards;

(2) meet the requirements of (e)(1) of this section with the landing gear retracted (if applicable); and

(3) have fireproof skin in areas subject to flame if a fire starts in or burns out of any designated fire zone.

(f) A means of retention for each openable or readily removable panel, cowling or engine or rotor drive system covering shall be provided to preclude hazardous damage to rotors or critical control components in the event of:

(1) structural or mechanical failure of the normal retention means, unless such failure is extremely improbable; or

(2) fire in a fire zone, if such fire could adversely affect the normal means of retention.

529.1194 Other Surfaces

All surfaces aft of, and near, engine compartments and designated fire zones, other than tail surfaces not subject to heat flames, or sparks emanating from a designated fire zone or engine compartment, shall be at least fire resistant.

529.1195 Fire Extinguishing Systems

(a) Each turbine engine powered rotorcraft and category A reciprocating engine powered rotorcraft, and each category B reciprocating engine powered rotorcraft with engines of more than 1,500 cubic inches (24.6 litres) shall have a fire extinguishing system for the designated fire zones. The fire extinguishing system for a powerplant shall be able to simultaneously protect all zones of the powerplant compartment for which protection is provided.

(b) For multi-engine powered rotorcraft, the fire extinguishing system, the quantity of extinguishing agent as and the rate of discharge shall:

(1) for each auxiliary power unit and combustion equipment, provide at least one adequate discharge; and

(2) for each other designated fire zone, provide two adequate discharges.

(c) For single engine rotorcraft, the quantity of extinguishing agent and the rate of discharge shall provide at least one adequate discharge for the engine compartment.

(d) It shall be demonstrated by either actual or simulated flight tests that under critical airflow conditions in flight the discharge of the extinguishing agent in each designated fire zone will provide an agent concentration capable of extinguishing fires in that zone and of minimizing the probability of re-ignition.

529.1196 Reserved

529.1197 Fire Extinguishing Agents

(a) Fire extinguishing agents shall:

(1) be capable of extinguishing flames emanating from any burning of fluids or other combustible materials in the area protected by the fire extinguishing system; and

(2) have thermal stability over the temperature range likely to be experienced in the compartment in which they are stored.

(b) If any toxic extinguishing agent is used it shall be demonstrated by test that entry of harmful concentrations of fluid or fluid vapours into any personnel compartment (due to leakage during normal operation of the rotorcraft, or discharge on the ground or in flight) is prevented, even though a defect may exist in the extinguishing system.

(c) Deleted.

529.1198 Reserved

529.1199 Extinguishing Agent Containers

(a) Each extinguishing agent container shall have a pressure relief to prevent bursting of the container by excessive internal pressures.

(b) The discharge end of each discharge line from a pressure relief connection shall be located so that discharge of the fire extinguishing agent would not damage the rotorcraft. The line shall also be located or protected to prevent clogging caused by ice or other foreign matter.

(c) There shall be a means for each fire extinguishing agent container to indicate that the container has discharged or that the charging pressure is below the established minimum necessary for proper functioning.

(d) The temperature of each container shall be maintained, under intended operating conditions, to prevent the pressure in the container from:

(1) falling below that necessary to provide an adequate rate of discharge; or

(2) rising high enough to cause premature discharge.

529.1200 Reserved

529.1201 Fire Extinguishing System Materials

(a) No materials in any fire extinguishing system shall react chemically with any extinguishing agent so as to create a hazard.

(b) Each system component in an engine compartment shall be fireproof.

529.1202 Reserved

529.1203 Fire Detector Systems

(a) For each turbine engine powered rotorcraft and category A reciprocating engine powered rotorcraft, and for each category B reciprocating engine powered rotorcraft with engines of more than 900 cubic inches (14.7 litres) displacement, there shall be approved, quick-acting fire detectors in designated fire zones and in the combustor, turbine and tailpipe sections of turbine installations (whether or not such sections are designated fire zones) in numbers and locations ensuring prompt detection of fire in those zones.

(b) Each fire detector shall be constructed and installed to withstand any vibration, inertia and other loads to which it would be subjected in operation.

(c) No fire detector shall be affected by any oil, water, other fluids or fumes that might be present.

(d) There shall be means to allow crew members to check, in flight, the functioning of each fire detector system electrical circuit.

(e) The wiring and other components of each fire detector system in an engine compartment shall be at least fire resistant.

(f) No fire detector system component for any fire zone may pass through another fire zone, unless:

(1) it is protected against the possibility of false warnings resulting from fires in zones through which it passes; or

(2) the zones involved are simultaneously protected by the same detector and extinguishing systems.

529.1204 to 529.1300 Reserved

SUBCHAPTER F
EQUIPMENT GENERAL

529.1301 Function and Installation

Each item of installed equipment shall meet the following requirements:

(a) it shall be of a kind and design appropriate to its intended function;

(b) it shall be labelled as to its identification, function, or operating limitations, or any applicable combination of these factors;

(c) it shall be installed according to limitations specified for that equipment; and

(d) it shall function properly when installed.

529.1301-1 Rotorcraft Operations After Ground Cold Soak

Substantiation of satisfactory operation of the rotorcraft as a total system, by cold weather testing or by documented evidence of satisfactory operation at low temperature, is required after the rotorcraft has experienced a prolonged exposure to ground ambient temperatures equal to or less than -35°C unless an alternative minimum ground ambient temperature has been proposed by the applicant and accepted by the Minister.

***Information Note**: No equivalent text is in the FAR.*

529.1302 Reserved

529.1303 Flight and Navigation Instruments

The following are required flight and navigational instruments:

(a) an airspeed indicator. For Category A rotorcraft with V_{NE} less than a speed at which unmistakable pilot cues provide overspeed warning, a maximum allowable airspeed indicator shall be provided. If maximum allowable airspeed varies with weight, altitude, temperature or r.p.m., the indicator shall demonstrate that variation;

(b) a sensitive altimeter;

(c) a magnetic direction indicator;

(d) a clock displaying hours, minutes and seconds with a sweep second pointer or digital presentation;

(e) a free-air temperature indicator;

(f) a non-tumbling gyroscopic bank and pitch indicator;

(g) a gyroscopic rate-of-turn indicator combined with an integral slip-skid indicator (turn-and-bank indicator) except only a slip-skid indicator is required on rotorcraft with a third attitude instrument system that:

(1) is useable through flight attitudes of ±80 degrees of pitch and ±120 degrees of roll;

(2) is powered from a source independent of the electrical generating system;

(3) continues reliable operation for a minimum of 30 minutes after total failure of the electrical generating system;

(4) operates independently of any other attitude indicating system;

(5) is operative without selection after total failure of the electrical generating system;

(6) is located on the instrument panel in a position acceptable to the Minister that will make it plainly visible to and useable by any pilot at his station; and

(7) is appropriately lighted during all phases of operation;

(h) a gyroscopic direction indicator;

(i) a rate-of-climb (vertical speed) indicator;

(j) for Category A rotorcraft, a speed warning device when V_{NE} is less than the speed at which unmistakable overspeed warning is provided by other pilot cues. The speed warning device shall give effective aural warning (differing distinctively from aural warnings used for other purposes) to the pilots whenever the indicated speed exceeds V_{NE} plus 3 knots and shall operate satisfactorily throughout the approved range of altitudes and temperatures.

529.1304 Reserved

529.1305 Powerplant Instruments

The following are required powerplant instruments:

(a) For each rotorcraft:

(1) a carburetor air temperature indicator for each reciprocating engine;

(2) a cylinder head temperature indicator for each air-cooled reciprocating engine, and a coolant temperature indicator for each liquid-cooled reciprocating engine;

(3) a fuel quantity indicator for each fuel tank;

(4) a low fuel warning device for each fuel tank which feeds an engine. This device shall:

(i) provide a warning to the crew when approximately 10 minutes of useable fuel remains in the tank, and

(ii) be independent of the normal fuel quantity indicating system;

(5) a manifold pressure indicator, for each reciprocating engine of the altitude type;

(6) an oil pressure indicator for each pressure-lubricated gearbox;
(amended 1997/04/07)

(7) an oil pressure warning device for each pressure-lubricated gearbox to indicate when the oil pressure falls below a safe value;
(amended 1997/04/07)

(8) an oil quantity indicator for each oil tank and each rotor drive gearbox, if lubricant is self-contained;
(amended 1997/04/07)

(9) an oil temperature indicator for each engine;
(amended 1997/04/07)

(10) an oil temperature warning device to indicate unsafe oil temperatures in each main rotor drive gearbox, including gearboxes necessary for rotor phasing;
(amended 1997/04/07)

(11) a gas temperature indicator for each turbine engine;
(amended 1997/04/07)

(12) a gas producer rotor tachometer for each turbine engine;
(amended 1997/04/07)

(13) a tachometer for each engine that, if combined with the applicable instrument required by (a)(14) of this section, indicates rotor r.p.m. during autorotation;
(amended 1997/04/07)

(14) at least one tachometer to indicate, as applicable:
(amended 1997/04/07)

(i) the r.p.m. of the single main rotor,

(ii) the common r.p.m. of any main rotors whose speeds cannot vary appreciably with respect to each other, and

(iii) the r.p.m. of each main rotor whose speed can vary appreciably with respect to that of another main rotor;

(15) a free power turbine tachometer for each turbine engine;
(amended 1997/04/07)

(16) a means, for each turbine engine, to indicate power for that engine;
(amended 1997/04/07)

(17) for each turbine engine, an indicator to indicate the functioning of the powerplant ice protection system;
(amended 1997/04/07)

(18) an indicator for the filter required by section 529.997 to indicate the occurrence of contamination of the filter to the degree established in compliance with section 529.955;
(amended 1997/04/07)

(19) for each turbine engine, a warning means for the oil strainer or filter required by section 529.1019, if it has no bypass, to warn the pilot of the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with section 529.1019 (a)(2);
(amended 1997/04/07)

(20) an indicator to indicate the functioning of any selectable or controllable heater used to prevent ice clogging of fuel system components;
(amended 1997/04/07)

(21) an individual fuel pressure indicator for each engine, unless the fuel system which supplies that engine does not employ any pumps, filters, or other components subject to degradation or failure which may adversely affect fuel pressure at the engine;
(amended 1997/04/07)

(22) a means to indicate to the flight crew the failure of any fuel pump installed to demonstrate compliance with section 529.955;
(amended 1997/04/07)

(23) warning or caution devices to signal to the flight crew when ferromagnetic particles are detected by the chip detector required by section 529.1337 (e);
(amended 1997/04/07)

(24) for auxiliary power units, an individual indicator, warning or caution device, or other means to advise the flight crew that limits are being exceeded, if exceeding these limits can be hazardous, for:
(amended 1997/04/07)

(i) gas temperature,

(ii) oil pressure, and

(iii) rotor speed;

(25) for rotorcraft for which a 30 second 2 minute-OEI power rating is requested, a means shall be provided to alert the pilot when the engine is at the 30 second and 2 minute-OEI power levels, when the event begins, and when the time interval expires; and
(amended 1997/04/07)

(26) for each turbine engine utilizing 30 second 2 minute-OEI power, a device or system shall be provided for use by ground personnel which:
(amended 1997/04/07)

(i) automatically records each usage and duration of power at the 30 second and 2 minute-OEI levels,

(ii) permits retrieval of the recorded data,

(iii) can be reset only by ground maintenance personnel, and

(iv) has a means to verify proper operation of the system or device;

(b) for Category A rotorcraft, the following are required:

(1) an individual oil pressure indicator for each engine, and either an independent warning device for each engine or a master warning device for the engines with means for isolating the individual warning circuit from the master warning device;

(2) an independent fuel pressure warning device for each engine or a master warning device for all engines with provision for isolating the individual warning device from the master warning device; and

(3) fire warning indicators;

(c) For Category B rotorcraft:

(1) an individual oil pressure indicator for each engine; and

(2) fire warning indicators, when fire detection is required.

529.1306 Reserved

529.1307 Miscellaneous Equipment

The following miscellaneous equipment is required:

(a) an approved seat for each occupant;

(b) a master switch arrangement for electrical circuits other than ignition;

(c) hand fire extinguishers;

(d) a windshield wiper or equivalent device for each pilot station; and

(e) a two-way radio communication system.

529.1308 Reserved

529.1309 Equipment, Systems, and Installations

(a) The equipment, systems, and installations whose functioning is required by this Manual shall be designed and installed to ensure that they perform their intended functions under any foreseeable operating condition.

(b) The rotorcraft systems and associated components, considered separately and in relation to other systems, shall be designed so that:

(1) for Category B rotorcraft, the equipment, systems and installations shall be designed to prevent hazards to the rotorcraft if they malfunction or fail; or

(2) for Category A rotorcraft:

(i) the occurrence of any failure condition which would prevent the continued safe flight and landing of the rotorcraft is extremely improbable, and

(ii) the occurrence of any other failure conditions which would reduce the capability of the rotorcraft or the ability of the crew to cope with adverse operating conditions is improbable.

(c) Warning information shall be provided to alert the crew to unsafe system operating conditions and to enable them to take appropriate corrective action. Systems, controls and associated monitoring and warning means shall be designed to minimize crew errors which could create additional hazards.

(d) Compliance with the requirements of (b)(2) of this section shall be demonstrated by analysis and, where necessary, by appropriate ground, flight or simulator tests. The analysis shall consider:

(1) possible modes of failure, including malfunctions and damage from external sources;

(2) the probability of multiple failures and undetected failures;

(3) the resulting effects on the rotorcraft and occupants, considering the stage of flight and operating conditions; and

(4) the crew warning cues, corrective action required and the capability of detecting faults.

(e) For Category A rotorcraft, each installation whose functioning is required by this Manual and which requires a power supply, is an "essential load" on the power supply. The power sources and the system shall be able to supply the following power loads in probable operating combinations and for probable durations:

(1) loads connected to the system with the system functioning normally;

(2) essential loads, after failure of any one prime mover, power converter, or energy storage device;

(3) essential loads, after failure of:

(i) any one engine, on rotorcraft with two engines, and

(ii) any two engines, on rotorcraft with three or more engines.

(f) In determining compliance with (e)(2) and (3) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required for controlled flight need not be considered for the two-engine- inoperative condition on rotorcraft with three or more engines.

(g) In demonstrating compliance with (a) and (b) of this section with regard to the electrical system and to equipment design and installation, critical environmental conditions shall be considered. For electrical generation, distribution and utilization equipment required by or used in complying with this Manual, except equipment covered by Technical Standard Orders containing environmental test procedures, the ability to provide continuous, safe service under foreseeable environmental conditions may be demonstrated by environmental tests, design analysis or reference to previous comparable service experience on other aircraft.

(h) In demonstrating compliance with (a) and (b) of this section, the effects of lightning strikes on the rotorcraft shall be considered.
(amended 1997/04/07)

529.1310 to 529.1316 Reserved
(amended 2008/10/30)

529.1317 *High-intensity Radiated Fields (HIRF) Protection*
(amended 2008/10/30)

(a) Except as provided in paragraph (d) of this section, each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the rotorcraft shall be designed and installed so that:
(amended 2008/10/30)

(1) The function is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment I, as described in Appendix E of this chapter;
(amended 2008/10/30)

(2) The system automatically recovers normal operation of that function, in a timely manner, after the rotorcraft is exposed to HIRF environment I, as described in Appendix E of this chapter, unless this conflicts with other operational or functional requirements of that system;
(amended 2008/10/30)

(3) The system is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment II, as described in Appendix E of this chapter; and
(amended 2008/10/30)

(4) Each function required during operation under visual flight rules is not adversely affected during and after the time the rotorcraft is exposed to HIRF environment III, as described in Appendix E of this chapter.
(amended 2008/10/30)

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the rotorcraft or the ability of the flight crew to respond to an adverse operating condition shall be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to:

equipment HIRF test level 1 or 2, as described in Appendix E of this chapter.
(amended 2008/10/30)

(c) Each electrical and electronic system that performs such a function whose failure would reduce the capability of the rotorcraft or the ability of the flight crew to respond to an adverse operating condition shall be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 3, as described in Appendix E of this chapter.
(amended 2008/10/30)

(d) Before December 1, 2012, an electrical or electronic system that performs a function whose failure would prevent the continued safe flight and landing of a rotorcraft may be designed and installed without meeting the provisions of paragraph (a) provided:
(amended 2008/10/30)

(1) The system has previously been shown to comply with Special Conditions - Airworthiness for HIRF, specified by the Minister pursuant to Part V of the *Canadian Aviation Regulations* (CARs);
(amended 2008/10/30)

(2) The HIRF immunity characteristics of the system have not changed since compliance with the special conditions was demonstrated; and
(amended 2008/10/30)

(3) The data used to demonstrate compliance with the Special Conditions - Airworthiness for HIRF is provided.
(amended 2008/10/30)

529.1318 to 529.1320 Reserved

(amended 2008/10/30)

Instruments Installation

529.1321 Arrangement and Visibility

(a) Each flight, navigation and powerplant instrument for use by any pilot shall be easily visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) Each instrument necessary for safe operation, including the airspeed indicator, gyroscopic direction indicator, gyroscopic bank-and-pitch indicator, slip-skid indicator, altimeter, rate-of-climb indicator, rotor tachometers and the indicator most representative of engine power shall be grouped and centred as nearly as practicable about the vertical plane of the pilot`s forward vision. In addition, for rotorcraft approved for IFR flight:

(1) the instrument that most effectively indicates attitude shall be on the panel in the top centre position;

(2) the instrument that most effectively indicates direction of flight shall be adjacent to and directly below the attitude instrument;

(3) the instrument that most effectively indicates airspeed shall be adjacent to and to the left of the attitude instrument; and

(4) the instrument that most effectively indicates altitude or is most frequently utilized in control of altitude shall be adjacent to and to the right of the attitude instrument.

(c) Other required powerplant instruments shall be closely grouped on the instrument panel.

(d) Identical powerplant instruments for the engines shall be located so as to prevent any confusion as to which engine each instrument relates.

(e) Each powerplant instrument vital to safe operation shall be plainly visible to appropriate crew members.

(f) Instrument panel vibration shall not damage or impair the readability or accuracy of any instrument.(g) If a visual indicator is provided to indicate malfunction of an instrument, it shall be effective under all probable cockpit lighting conditions.

529.1322 Warning, Caution, and Advisory Lights

Unless otherwise approved by the Minister, if warning, caution or advisory lights are installed in the cockpit, they shall be:

(a) red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) amber, for caution lights (lights indicating the possible need for future corrective action);

(c) green, for safe operation lights; and

(d) any other colour, including white, for lights not described in (a) through (c) of this section, provided the colour differs sufficiently from the colours prescribed in (a) through (c) of this section to avoid possible confusion.

529.1323 Airspeed Indicating System

For each airspeed indicating system, the following apply:

(a) each airspeed indicating instrument shall be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration error when the corresponding pitot and static pressures are applied;

(b) each system shall be calibrated to determine system error excluding airspeed instrument error. This calibration shall be determined as follow:

(1) in level flight at speeds of 20 knots and greater, and over an appropriate range of speeds for flight conditions of climb and autorotation; and

(2) during takeoff, with repeatable and readable indications that ensure:

(i) consistent realization of the field lengths specified in the *Rotorcraft Flight Manual*, and

(ii) avoidance of the critical areas of the height-velocity envelope established under section 529.87;
(amended 1999/12/01)

(c) For Category A rotorcraft. The following apply:

(1) the indication shall allow consistent definition of the take-off decision point; and (amended 1999/12/01)

(2) the system error, excluding the airspeed instrument calibration error, shall not exceed:

(i) three percent or 5 knots, whichever is greater, in level flight at speeds above 80 percent of take-off safety speed, and

(ii) ten knots in climb at speeds from 10 knots below take-off safety speed to 10 knots above V_Y;

(d) for Category B rotorcraft, the system error, excluding the airspeed instrument calibration error, shall not exceed 3 percent or 5 knots, whichever is greater, in level flight at speeds above 80 percent of the climb-out speed attained at 50 feet (15.24 m) when complying with section 529.63;

(e) each system shall be arranged, so far as practicable, to prevent malfunction or serious error due to the entry of moisture, dirt, or other substances;

(f) each system shall have a heated pitot tube or an equivalent means of preventing malfunction due to icing.

529.1324 Reserved

529.1325 Static Pressure and Pressure Altimeter Systems

(a) Each instrument with static air case connections shall be vented to the outside atmosphere through an appropriate piping system.

(b) Each vent shall be located where its orifices are least affected by airflow variation, moisture or other foreign matter.

(c) Each static pressure port shall be designed and located in such manner that the correlation between air pressure in the static pressure system and true ambient atmospheric static pressure is not altered when the rotorcraft encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in

demonstrating compliance with this requirement. If the reading of the altimeter, when on the alternate static pressure system, differs from the reading of the altimeter when on the primary static system by more than 50 feet (15.24 m), a correction card shall be provided for the alternate static system.

(d) Except for the vent into the atmosphere, each system shall be airtight.

(e) Each pressure altimeter shall be approved and calibrated to indicate pressure altitude in a standard atmosphere with a minimum practicable calibration error when the corresponding static pressures are applied.

(f) Each system shall be designed and installed so that an error in indicated pressure altitude, at sea level, with a standard atmosphere, excluding instrument calibration error, does not result in an error of more than ±30 feet (9 m) per 100 knots speed. However, the error need not be less than ± 30 feet (9 m).

(g) Except as provided in (h) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source shall be designed so that:

(1) when either source is selected, the other is blocked off; and

(2) both sources cannot be blocked off simultaneously.

(h) For un-pressurized rotorcraft, (g)(1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

529.1326 Reserved

529.1327 Magnetic Direction Indicator

(a) Each magnetic direction indicator shall be installed so that its accuracy is not excessively affected by the rotorcraft's vibration or magnetic fields.

(b) The compensated installation shall not have a deviation, in level flight, greater than 10° on any heading.

529.1328 Reserved

529.1329 Automatic Pilot System

(a) Each automatic pilot system shall be designed so that the automatic pilot can:

(1) be sufficiently overpowered by one pilot to allow control of the rotorcraft; and

(2) be readily and positively disengaged by each pilot to prevent it from interfering with the control of the rotorcraft.

(b) Unless there is automatic synchronization, each system shall have a means to readily indicate to the pilot the alignment of the actuating device in relation to the control system it operates.

(c) Each manually operated control for the system's operation shall be readily accessible to the pilots.

(d) The system shall be designed and adjusted so that, within the range of adjustment available to the pilot, it cannot produce hazardous loads on the rotorcraft, or create hazardous deviations in the flight path, under any flight condition appropriate to its use, either during normal operation or in the event of a malfunction, assuming that corrective action begins within a reasonable period of time.

(e) If the automatic pilot integrates signals from auxiliary controls or furnishes signals for operation of other equipment, there shall be positive interlocks and sequencing of engagement to prevent improper operation.

(f) If the automatic pilot system can be coupled to airborne navigation equipment, means shall be provided to indicate to the pilots the current mode of operation. Selector switch position is not acceptable as a means of indication.
(amended 1998/11/23)

529.1330 Reserved

529.1331 Instruments Using a Power Supply

For Category A rotorcraft:

(a) each required flight instrument using a power supply shall have:

(1) two independent sources of power;

(2) a means of selecting either power source; and

(3) a visual means integral with each instrument to indicate when the power adequate to sustain proper instrument performance is not being supplied. The power shall be measured at or near the point where it enters the instrument. For electrical instruments, the power is considered to be adequate when the voltage is within the approved limits; and

(b) the installation and power supply system shall be such that failure of any flight instrument connected to one source, of the energy supply from one source or a fault in any part of the power distribution system does not interfere with the proper supply of energy from any other source.

529.1332 Reserved

529.1333 Instrument Systems

For systems that operate the required flight instruments which are located at each

pilot's station, the following apply:

(a) only the required flight instruments for the first pilot may be connected to that operating system;

(b) the equipment, systems and installation shall be designed so that one display of the information essential to the safety of flight which is provided by the flight instruments remains available to a pilot, without additional crew member action, after any single failure or combination of failures that are not demonstrated to be extremely improbable; and

(c) additional instruments, systems or equipment shall not be connected to the operating system for a second pilot unless provisions are made to ensure the continued normal functioning of the required flight instruments in the event of any malfunction of the additional instruments, systems or equipment which is not demonstrated to be extremely improbable.

529.1334 Reserved

529.1335 Flight Director Systems

If a flight director system is installed, means shall be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

529.1336 Reserved

529.1337 Powerplant Instruments

(a) Instruments and instrument lines.

(1) Each powerplant and auxiliary power unit instrument line shall meet the requirements of sections 529.993 and 529.1183;

(2) Each line carrying flammable fluids under pressure shall:

(i) have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails, and

(ii) be installed and located so that the escape of fluids would not create a hazard;

(3) Each powerplant and auxiliary power unit instrument that utilizes flammable fluids shall be installed and located so that the escape of fluid would not create a hazard.

(b) Fuel quantity indicator. There shall be means to indicate to the flight crew members the quantity, in gallons or equivalent units, of useable fuel in each tank during flight. In addition:

(1) each fuel quantity indicator shall be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unuseable fuel supply

determined under section 529.959;

(2) when two or more tanks are closely interconnected by a gravity feed system and vented, and when it is impossible to feed from each tank separately, at least one fuel quantity indicator shall be installed;

(3) tanks with interconnected outlets and airspaces may be treated as one tank and need not have separate indicators; and

(4) each exposed sight gauge used as a fuel quantity indicator shall be protected against damage.

(c) Fuel flow meter system. If a fuel flow meter system is installed, each metering component shall have a means for bypassing the fuel supply if malfunction of that component severely restricts fuel flow.

(d) Oil quantity indicator. There shall be a stick gauge or equivalent means to indicate the quantity of oil:

(1) in each tank; and

(2) in each transmission gearbox.

(e) Rotor drive system transmissions and gearboxes utilizing ferromagnetic materials shall be equipped with chip detectors designed to indicate the presence of ferromagnetic particles resulting from damage or excessive wear within the transmission or gearbox. Each chip detector shall:

(1) be designed to provide a signal to the indicator required by section 529.1305 (a)(22); and

(2) be provided with a means to allow crew members to check, in flight, the function of each detector electrical circuit and signal.

529.1338 to 529.1350 Reserved

Electrical Systems and Equipment

529.1351 General

(a) Electrical system capacity. The required generating capacity and the number and kind of power sources shall:

(1) be determined by an electrical load analysis; and

(2) meet the requirements of section 529.1309.

(b) Generating system. The generating system includes electrical power sources, main power busses, transmission cables and associated control, regulation and protective devices. It shall be designed so that:

(1) power sources function properly when independent and when connected in combination;

(2) no failure or malfunction of any power source can create a hazard or impair the ability of remaining sources to supply essential loads;

(3) the system voltage and frequency (as applicable) at the terminals of essential load equipment can be maintained within the limits for which the equipment is designed, during any probable operating condition;

(4) system transients due to switching, fault clearing or other causes do not make essential loads inoperative, and do not cause a smoke or fire hazard;

(5) there are means accessible in flight to appropriate crew members for the individual and collective disconnection of the electrical power sources from the main bus; and

(6) there are means to indicate to appropriate crew members the generating system quantities essential for the safe operation of the system, such as the voltage and current supplied by each generator.

(c) External power. If provisions are made for connecting external power to the rotorcraft, and that external power can be electrically connected to equipment other than that used for engine starting, means shall be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the rotorcraft's electrical system.

(d) Operation with the normal electrical power generating system inoperative. (amended 1997/04/07)

(1) the applicant shall demonstrate, by analysis or tests, that the rotorcraft can be operated safely in VFR conditions for a period not less than 5 minutes, with the normal electrical power generating system (electrical power sources excluding the battery) inoperative, with critical type fuel (from the standpoint of flameout and restart capability), and with the rotorcraft initially at the maximum certificated altitude. Parts of the electrical system may remain on if:
(amended 1997/04/07)

(i) a single malfunction, including a wire bundle or junction box fire, cannot result in loss of the part turned off and the part turned on, and

(ii) the parts turned on are electrically and mechanically isolated from the parts turned off,

(iii) Removed;

(2) Additional requirements for Category A Rotorcraft are as follow:
(amended 1997/04/07)

(i) unless the applicant can demonstrate that the loss of the normal electrical power generating system is extremely improbable, an emergency electrical power system, independent of the normal electrical power generating system, shall be provided with sufficient capacity to power all systems necessary for continued

safe flight and landing,

(ii) failures, including junction box, control panel or wire bundle fires, which would result in the loss of the normal and emergency systems, shall be demonstrated to be extremely improbable, and

(iii) systems necessary for immediate safety shall continue to operate following the loss of the normal electrical power generating system, without the need for flight crew action.

(3) Removed
(amended 1998/11/23)

529.1352 Reserved

529.1353 Electrical Equipment and Installations

(a) Electrical equipment, controls and wiring shall be installed so that operation of any one unit or system of units will not adversely affect the simultaneous operation of any other electrical unit or system essential to safe operation.

(b) Cables shall be grouped, routed and spaced so that damage to essential circuits will be minimized if there are faults in heavy current-carrying cables.

(c) Storage batteries shall be designed and installed as follows:

(1) safe cell temperatures and pressures shall be maintained during any probable charging and discharging condition. No uncontrolled increase in cell temperature shall result when the battery is recharged (after previous complete discharge):

(i) at maximum regulated voltage or power,

(ii) during a flight of maximum duration, and

(iii) under the most adverse cooling condition likely in service;

(2) compliance with (c)(1) of this section, shall be demonstrated by test unless experience with similar batteries and installations has demonstrated that maintaining safe cell temperatures and pressures presents no problem;

(3) no explosive or toxic gases emitted by any battery in normal operation, or as the result of any probable malfunction in the charging system or battery installation, shall accumulate in hazardous quantities within the rotorcraft;

(4) no corrosive fluids or gases that may escape from the battery shall damage surrounding structures or adjacent essential equipment;

(5) each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit shall have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells;

(6) nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit shall have:

(i) a system to control the charging rate of the battery automatically so as to prevent battery overheating,

(ii) a battery temperature sensing and over-temperature warning system with a means for disconnecting the battery from its charging source in the event of an over-temperature condition, or

(iii) a battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.

529.1354 Reserved

529.1355 Distribution System

(a) The distribution system includes the distribution busses, their associated feeders, and each control and protective device.

(b) If two independent sources of electrical power for particular equipment or systems are required by this Manual, in the event of the failure of one power source for such equipment or system, another power source (including its separate feeder) shall be provided automatically or be manually selectable to maintain equipment or system operation.

529.1356 Reserved

529.1357 Circuit Protective Devices

(a) Automatic protective devices shall be used to minimize distress to the electrical system and hazard to the rotorcraft in the event of wiring faults or serious malfunction of the system or connected equipment.

(b) The protective and control devices in the generating system shall be designed to de-energize and disconnect faulty power sources and power transmission equipment from their associated busses with sufficient rapidity to provide protection from hazardous over-voltage and other malfunctioning.

(c) Each resettable circuit protective device shall be designed so that, when an overload or circuit fault exists, it will open the circuit regardless of the position of the operating control.

(d) If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse shall be located and identified so that it can be readily reset or replaced in flight.

(e) Each essential load shall have individual circuit protection. However, individual protection for each circuit in an essential load system (such as each position light circuit in a system) is not required.

(f) If fuses are used, there shall be spare fuses for use in flight equal to at least 50 percent of the number of fuses of each rating required for complete circuit protection.

(g) Automatic reset circuit breakers may be used as integral protectors for electrical equipment provided there is circuit protection for the cable supplying power to the equipment.

529.1358 Reserved

529.1359 Electrical System Fire and Smoke Protection

(a) Components of the electrical system shall meet the applicable fire and smoke protection provisions of sections 529.831 and 529.863.

(b) Electrical cables, terminals and equipment, in designated fire zones, and that are used in emergency procedures, shall be at least fire resistant.

(c) Insulation on electrical wire and cable installed in the rotorcraft shall be self-extinguishing when tested in accordance with Appendix F, Part I(a)(3), of Chapter 525 of this Manual.
(amended 1998/11/23)

529.1360 to 1362 Reserved

529.1363 Electrical System Tests

(a) When laboratory tests of the electrical system are conducted:

(1) the tests shall be performed on a mock-up using the same generating equipment used in the rotorcraft;

(2) the equipment shall simulate the electrical characteristics of the distribution wiring and connected loads to the extent necessary for valid test results; and

(3) laboratory generator drives shall simulate the prime movers on the rotorcraft with respect to their reaction to generator loading, including loading due to faults.

(b) For each flight condition that cannot be simulated adequately in the laboratory or by ground tests on the rotorcraft, flight tests shall be made.

529.1364 to 529.1380 Reserved

Lights

529.1381 Instrument Lights

The instrument lights shall:

(a) make each instrument, switch and other device for which they are provided easily readable; and

(b) be installed so that:

(1) their direct rays are shielded from the pilot's eyes; and

(2) no objectionable reflections are visible to the pilot.

529.1382 Reserved

529.1383 Landing Lights

(a) Each required landing or hovering light shall be approved.

(b) Each landing light shall be installed so that:

(1) no objectionable glare is visible to the pilot;

(2) the pilot is not adversely affected by halation; and

(3) it provides enough light for night operation, including hovering and landing.

(c) At least one separate switch shall be provided, as applicable:

(1) for each separately installed landing light; and

(2) for each group of landing lights installed at a common location.

529.1384 Reserved

529.1385 Position Light System Installation

(a) General. Each part of each position light system shall meet the applicable requirements of this section and each system as a whole shall meet the requirements of sections 529.1387 through 529.1397.

(b) Forward position lights. Forward position lights shall consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the rotorcraft so that, with the rotorcraft in the normal flying position, the red light is on the left side, and the green light is on the right side. Each light shall be approved.

(c) Rear position light. The rear position light shall be a white light mounted as far aft as practicable, and shall be approved.

(d) Circuit. The two forward position lights and the rear position light shall make a single circuit.

(e) Light covers and colour filters. Each light cover or colour filter shall be at least flame resistant and shall not change colour or shape or lose any appreciable light transmission during normal use.

529.1386 Reserved

529.1387 Position Light System Dihedral Angles

(a) Except as provided in (e) of this section, each forward and rear position shall, as installed, demonstrate unbroken light within the dihedral angles described in this section.

(b) Dihedral angle L (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the rotorcraft, and the other at 110° to the left of the first, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle R (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the rotorcraft, and the other at 110° to the right of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle A (aft) is formed by two intersecting vertical planes making angles of 70° to the right and to the left, respectively, to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(e) If the rear position light, when mounted as far aft as practicable in accordance with section 529.1385 (c), cannot demonstrate unbroken light within dihedral angle A (as defined in (d) of this section), a solid angle or angles of obstructed visibility totalling not more than 0.04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30° with a vertical line passing through the rear position light.

529.1388 Reserved

529.1389 Position Light Distribution and Intensities

(a) General. The intensities prescribed in this section shall be provided by new equipment with light covers and colour filters in place. Intensities shall be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the rotorcraft. The light distribution and intensity of each position light shall meet the requirements of (b) of this section.

(b) Forward and rear position lights. The light distribution and intensities of forward and rear position lights shall be expressed in terms of minimum intensities in the horizontal plane, minimum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles, L, R, and A, and shall meet the following requirements:

(1) Intensities in the horizontal plane. Each intensity in the horizontal plane (the plane containing the longitudinal axis of the rotorcraft and perpendicular to the plane of symmetry of the rotorcraft), shall equal or exceed the values in section 529.1391;

(2) Intensities in any vertical plane. Each intensity in any vertical plane (the plane perpendicular to the horizontal plane) shall equal or exceed the appropriate value in section 529.1393 where I is the minimum intensity prescribed in section 529.1391 for the corresponding angles in the horizontal plane;

(3) Intensities in overlaps between adjacent signals. No intensity in any overlap between adjacent signals shall exceed the values in section 529.1395, except that higher intensities in overlaps may be used with the use of main beam intensities substantially greater than the minima specified in sections 529.1391 and 529.1393 if the overlap intensities in relation to the main beam intensities do not adversely affect signal clarity.

529.1390 Reserved

529.1391 Minimum Intensities in the Horizontal Plane of Forward and Rear Position Lights

Each position light intensity shall equal or exceed the applicable values in the following table:

Dihedral angle (light included)	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity (candles)
L and R (forward red and green).	0° to 10°	40
	10° to 20°	30
	20° to 110°	5
A (rear white)	110° to 180°	20

529.1392 Reserved

529.1393 Minimum Intensities in Any Vertical Plane of Forward and Rear Position Lights

Each position light intensity shall equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane	Intensity (I)
0°	1.00
0° to 5°	0.90
5° to 10°	0.80

10° to 15°	0.70
15° to 20°	0.50
20° to 30°	0.30
30° to 40°	0.10
40° to 90°	0.05

529.1394 Reserved

529.1395 Maximum Intensities in Overlapping Beams of Forward and Rear Position Lights

No position light intensity shall exceed the applicable values in the following table, except as provided in section 529.1389 (b)(3).

Overlaps	Maximum intensity	
	Area A (candles)	Area B (candles)
Green in dihedral angle L	10	1
Red in dihedral angle R	10	1
Green in dihedral angle A	5	1
Red in dihedral angle A	5	1
Rear white in dihedral angle L	5	1
Rear white in dihedral angle R	5	1

Where:

(a) Area A includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 10° but less than 20°;

(b) Area B includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 20°.

529.1396 Reserved

529.1397 Colour Specifications

Each position light colour shall have the applicable International Commission on Illumination chromaticity co-ordinates as follows:

(a) Aviation red

"y" is not greater than 0.335, and

"z" is not greater than 0.002;

(b) Aviation green

"x" is not greater than 0.440-0.320y,

"x" is not greater than y-0.170, and

"y" is not less than 0.390-0.170x;

(c) Aviation white

"x" is not less than 0.300 and not greater than 0.540,

"y" is not less than "x-0.040", or

"y_c - 0.010", whichever is the smaller, and

"y" is not greater than "x+0.020" nor "0.636-0.400x".

Where "y_e" is the "y" co-ordinate of the Planckian radiator for the value of "x" considered.

529.1398 Reserved

529.1399 Riding Light

(a) Each riding light required for water operation shall be installed so that it can:

(1) demonstrate a white light for at least two miles at night under clear atmospheric conditions; and

(2) demonstrate a maximum practicable unbroken light with the rotorcraft on the water.

(b) Externally hung lights may be used.

529.1400 Reserved

529.1401 Anticollision Light System

(a) General. If certification for night operation is requested, the rotorcraft shall have an anticollision light system that:

(1) consists of one or more approved anticollision lights located so that their emitted light will not impair the crew's vision or detract from the conspicuity of the position lights; and

(2) meets the requirements of (b) through (f) of this section.

(b) Field of coverage. The system shall consist of enough lights to illuminate the vital areas around the rotorcraft, considering the physical configuration and flight characteristics of the rotorcraft. The field of coverage shall extend in each direction

within at least 30° above and 30° below the horizontal plane of the rotorcraft, except that there may be solid angles of obstructed visibility totalling not more than 0.5 steradians.

(c) Flashing characteristics. The arrangement of the system, that is, the number of light sources, beam width, speed of rotation and other characteristics shall give an effective flash frequency of not less than 40, nor more than 100, cycles per minute. The effective flash frequency is the frequency at which the rotorcraft's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180, cycles per minute.

(d) Colour. Each anticollision light shall be aviation red and shall meet the applicable requirements of section 529.1397.

(e) Light intensity. The minimum light intensities in any vertical plane, measured with the red filter (if used) and expressed in terms of "effective" intensities, shall meet the requirements of (f) of this section. The following relation shall be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)\,dt}{0.2 + (t_2 - t_1)}$$

where:

I_e = effective intensity (candles);

$I(t)$ = instantaneous intensity as a function of time;

$(t_1 - t_2)$ = flash time interval (seconds);

normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

(f) Minimum effective intensities for anticollision light. Each anticollision light effective intensity shall equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane	Effective Intensity (candles)
0° to 5°	150
5° to 10°	90
10° to 20°	30
20° to 30°	15

529.1402 to 529.1410 Reserved

Safety Equipment

529.1411 General

(a) Accessibility. Required safety equipment to be used by the crew in an emergency, such as automatic life raft releases, shall be readily accessible.

(b) Stowage provisions. Stowage provisions for required emergency equipment shall be furnished and shall:

(1) be arranged so that the equipment is directly accessible and its location is obvious; and

(2) protect the safety equipment from inadvertent damage.

(c) Emergency exit descent device. The stowage provisions for the emergency exit descent device required by 529.809 (f) shall be at the exits for which they are intended.

(d) Life rafts. Life rafts shall be stowed near exits through which the rafts can be launched during an unplanned ditching. Rafts automatically or remotely released outside the rotorcraft shall be attached to the rotorcraft by the static line prescribed in section 529.1415.

(e) Long-range signalling device. The stowage provisions for the long-range signalling device required by section 529.1415 shall be near an exit available during an unplanned ditching.

(f) Life preservers. Each life preserver shall be within easy reach of each occupant while seated.

529.1412 Reserved

529.1413 Safety Belts: Passenger Warning Device

(a) If there are means to indicate to the passengers when safety belts should be fastened, they shall be installed to be operated from either pilot seat.

(b) Each safety belt shall be equipped with a metal to metal latching device.

529.1414 Reserved

529.1415 Ditching Equipment

(a) Emergency flotation and signalling equipment required by any operating rule shall meet the requirements of this section.

(b) Each life raft and each life preserver shall be approved. In addition:

(1) provide not less than two rafts, of an approximately equal rated capacity and

buoyancy to accommodate the occupants of the rotorcraft; and

(2) each raft shall have a trailing line, and shall have a static line designed to hold the raft near the rotorcraft but to release it if the rotorcraft becomes totally submerged.

(c) Approved survival equipment shall be attached to each life raft.

(d) There shall be an approved survival type emergency locator transmitter for use in one life raft.
(amended 1995/03/25)

529.1416 to 529.1418 Reserved

529.1419 Ice Protection

(a) To obtain certification for flight into icing conditions, compliance with this section shall be demonstrated.

(b) It shall be demonstrated that the rotorcraft can be safely operated in the continuous maximum and intermittent maximum icing conditions determined under Appendix C of this Chapter within the rotorcraft altitude envelope. An analysis shall be performed to establish, on the basis of the rotorcraft's operational needs, the adequacy of the ice protection system for the various components of the rotorcraft.

(c) In addition to the analysis and physical evaluation prescribed in (b) of this section, the effectiveness of the ice protection system and its components shall be demonstrated by flight tests of the rotorcraft or its components in measured natural atmospheric icing conditions and by one or more of the following tests as found necessary to determine the adequacy of the ice protection system:

(1) laboratory dry air or simulated icing tests, or a combination of both, of the components or models of the components;

(2) flight dry air tests of the ice protection system as a whole, or its individual components;

(3) flight tests of the rotorcraft or its components in measured simulated icing conditions.

(d) The ice protection provisions of this section are considered to be applicable primarily to the airframe. Powerplant installation requirements are contained in Subchapter E of this Chapter.

(e) A means shall be identified or provided for determining the formation of ice on critical parts of the rotorcraft. Unless otherwise restricted, the means shall be available for night-time as well as daytime operation. The *Rotorcraft Flight Manual* shall describe the means of determining ice formation and shall contain information necessary for safe operation of the rotorcraft in icing conditions.

529.1420 to 529.1430 Reserved

Miscellaneous Equipment

529.1431 Electronic Equipment

(a) Radio communication and navigation installations shall be free from hazards in themselves, in their method or operation, and in their effects on other components, under any critical environmental conditions.

(b) Radio communication and navigation equipment, controls and wiring shall be installed so that operation of any one unit or system of units will not adversely affect the simultaneous operation of any other radio or electronic unit, or system of units, required by this Manual.

529.1432 Reserved

529.1433 Vacuum Systems

(a) There shall be means, in addition to the normal pressure relief, to automatically relieve the pressure in the discharge lines from the vacuum air pump when the delivery temperature of the air becomes unsafe.

(b) Each vacuum air system line and fitting on the discharge side of the pump that might contain flammable vapours or fluids shall meet the requirements of section 529.1183 if they are in a designated fire zone.

(c) Other vacuum air system components in designated fire zones shall be at least fire resistant.

529.1434 Reserved

529.1435 Hydraulic Systems

(a) Design. Each hydraulic system shall be designed as follows:

(1) each element of the hydraulic system shall be designed to withstand, without detrimental, permanent deformation, any structural loads that may be imposed simultaneously with the maximum operating hydraulic loads;

(2) each element of the hydraulic system shall be designed to withstand pressures sufficiently greater than those prescribed in (b) of this section to demonstrate that the system will not rupture under service conditions;

(3) there shall be means to indicate the pressure in each main hydraulic power system;

(4) there shall be means to ensure that no pressure in any part of the system will exceed a safe limit above the maximum operating pressure of the system, and to prevent excessive pressures resulting from any fluid volumetric change in lines

likely to remain closed long enough for such a change to take place. The possibility of detrimental transient (surge) pressure during operation shall be considered;

(5) each hydraulic line, fitting and component shall be installed and supported to prevent excessive vibration and to withstand inertia loads. Each element of the installation shall be protected from abrasion, corrosion and mechanical damage;

(6) means for providing flexibility shall be used to connect points, in a hydraulic fluid line, between which relative motion or differential vibration exists.

(b) Tests. Each element of the system shall be tested to a proof pressure of 1.5 times the maximum pressure to which that element will be subjected in normal operation, without failure, malfunction, or detrimental deformation, of any part of the system.

(c) Fire protection. Each hydraulic system using flammable hydraulic fluid shall meet the applicable requirements of sections 529.861, 529.1183, 529.1185, and 529.1189.

529.1436 to 529.1438 Reserved

529.1439 Protective Breathing Equipment

(a) If one or more cargo or baggage compartments are to be accessible in flight, protective breathing equipment shall be available for an appropriate crew member.

(b) For protective breathing equipment required by (a) of this section or by any operating rule of this Manual:

(1) that equipment shall be designed to protect the crew from smoke, carbon dioxide and other harmful gases while on flight deck duty;

(2) that equipment shall include:

(i) masks covering the eyes, nose and mouth, or

(ii) masks covering the nose and mouth, plus accessory equipment to protect the eyes; and

(3) that equipment shall supply protective oxygen of 10 minutes duration per crew member at a pressure altitude of 8,000 feet (2 400 m) with a respiratory minute volume of 30 litres per minute BTPD.

529.1440 to 529.1456 Reserved

529.1457 Cockpit Voice Recorders

(a) Each cockpit voice recorder required by any applicable operating rule shall be approved, and shall be installed so that it will record the following:

(1) voice communications transmitted from or received in the rotorcraft by radio;

(2) voice communications of flight crew members on the flight deck;

(3) voice communications of flight crew members on the flight deck, using the

rotorcraft's interphone system;

(4) voice or audio signals identifying navigation or approach aids introduced into a headset or speaker;

(5) voice communications of flight crew members using the passenger loudspeaker system, if there is such a system, and if the fourth channel is available in accordance with the requirements of (c)(4)(ii) of this section.

(6) If datalink communication equipment is installed, all datalink communications, using an approved data message set. Datalink messages must be recorded as the output signal from the communications unit that translates the signal into usable data.
(amended 2009/05/11)

(b) The recording requirements of (a)(2) of this section may be met:

(1) by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crew members on the flight deck when directed to those stations; or

(2) by installing a continually energized or voice-actuated lip microphone at the first and second pilot stations. The microphone specified in (b) shall be so located and, if necessary, the preamplifiers and filters of the recorder shall be so adjusted or supplemented, that the recorded communications are intelligible when recorded under flight cockpit noise conditions and played back. The level of intelligibility shall be approved by the Minister. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder shall be installed so that the part of the communication or audio signals specified in (a) of this section obtained from each of the following sources is recorded on a separate channel:

(1) for the first channel, from each microphone, headset or speaker used at the first pilot station;

(2) for the second channel, from each microphone, headset or speaker used at the second pilot station;

(3) for the third channel, from the cockpit-mounted area microphone, or the continually energized or voice actuated lip microphones at the first and second pilot stations; and

(4) for the fourth channel, from:

(i) each microphone, headset or speaker used at the stations for the third and fourth crew members,

(ii) if the stations specified in (c)(i) or (c)(ii) of this section are not required or if the signal at such a station is picked up by another channel, each microphone on

the flight deck that is used with the passenger loudspeaker system if its signals are not picked up by another channel, or

(iii) each microphone on the flight deck that is used with the rotorcraft's loudspeaker system if its signals are not picked up by another channel.

(d) Each cockpit voice recorder shall be installed so that:

(1) It receives its electric power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads. The cockpit voice recorder must remain powered for as long as possible without jeopardizing emergency operation of the rotorcraft;
(amended 2009/05/11)

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact;

(3) There is an aural or visual means for pre-flight checking of the recorder for proper operation;

(4) Whether the cockpit voice recorder and digital flight data recorder are installed in separate boxes or in a combination unit, no single electrical failure external to the recorder may disable both the cockpit voice recorder and the digital flight data recorder; and
(amended 2009/05/11)

(5) It has an independent power source:
(amended 2009/05/11)

(i) That provides 10 ± 1 minutes of electrical power to operate both the cockpit voice recorder and cockpit-mounted area microphone;
(amended 2009/05/11)

(ii) That is located as close as practicable to the cockpit voice recorder; and
(amended 2009/05/11)

(iii) To which the cockpit voice recorder and cockpit-mounted area microphone are switched automatically in the event that all other power to the cockpit voice recorder is interrupted either by normal shutdown or by any other loss of power to the electrical power bus.
(amended 2009/05/11)

(e) The record container shall be located and mounted to minimize the probability of rupture of the container as a result of crash impact and consequent heat damage to the record from fire.

(f) If the cockpit voice recorder has a bulk erasure device, the installation shall be designed to minimize the probability of inadvertent operation and actuation of the device during crash impact.

(g) Each recorder container shall be either bright orange or bright yellow.

(h) When both a cockpit voice recorder and a flight data recorder are required by the operating rules, one combination unit may be installed, provided that all other requirements of this section and the requirements for flight data recorders under this chapter are met.
(amended 2009/05/11)

529.1458 Reserved

529.1459 Flight Data Recorders
(amended 2009/05/11)

(a) Each flight recorder required by the applicable operating rules shall be installed so that:

(1) it is supplied with airspeed, altitude and directional data obtained from sources that meet the accuracy requirements of sections 529.1323, 529.1325, and 529.1327 of this part, as applicable;

(2) the vertical acceleration sensor is rigidly attached, and located longitudinally within the approved centre of gravity limits of the rotorcraft;

(3) it receives its electrical power from the bus that provides the maximum reliability for operation of the flight data recorder without jeopardizing service to essential or emergency loads. The flight data recorder must remain powered for as long as possible without jeopardizing emergency operation of the rotorcraft;
(amended 2009/05/11)

(4) there is an aural or visual means for pre-flight checking of the recorder for proper recording of data in the storage medium;

(5) except for recorders powered solely by the engine-drive electrical generator system, there is an automatic means to simultaneously stop a recorder that has a data erasure feature and prevent each erasure feature from functioning, within 10 minutes after any crash impact; and

(6) Whether the cockpit voice recorder and digital flight data recorder are installed in separate boxes or in a combination unit, no single electrical failure external to the recorder may disable both the cockpit voice recorder and the digital flight data recorder.
(amended 2009/05/11)

(b) Each non-ejectable recorder container shall be located and mounted so as to minimize the probability of container ruptures resulting from crash impact and subsequent damage to the record from fire.

(c) A correlation shall be established between the flight recorder readings of airspeed, altitude, and heading and the corresponding readings (taking into account correction factors) of the first pilot's instruments. This correlation shall cover the airspeed range over which the aircraft is to be operated, the range of altitude to which the aircraft is

limited, and 360 degrees of heading. Correlation may be established on the ground as appropriate.

(d) Each recorder container shall:

(1) be either bright orange or bright yellow;

(2) have a reflective tape affixed to its external surface to facilitate its location under water; and

(3) have an underwater locating device, when required by the applicable operating rules, on or adjacent to the container which is secured in such a manner that it is not likely to be separated during crash impact.

(e) When both a cockpit voice recorder and a flight data recorder are required by the operating rules, one combination unit may be installed, provided that all other requirements of this section and the requirements for cockpit voice recorders under this chapter are met.
(amended 2009/05/11)

529.1460 Reserved

529.1461 Equipment Containing High Energy Rotors

(a) Equipment containing high energy rotors shall meet (b), (c), or (d) of this section.

(b) High energy rotors contained in equipment shall be able to withstand damage caused by malfunctions, vibration, abnormal speeds and abnormal temperatures. In addition:

(1) auxiliary rotor cases shall be able to contain damage caused by the failure of high energy rotor blades; and

(2) equipment control devices, systems and instrumentation shall reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It shall be demonstrated by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors shall be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

529.1462 to 529.1500 Reserved

SUBCHAPTER G OPERATING LIMITATIONS AND INFORMATION

529.1501 General

(a) Each operating limitation specified in sections 529.1503 through 529.1525 and other limitations and information necessary for safe operation shall be established.

(b) The operating limitations and other information necessary for safe operation shall be made available to the crew members as prescribed in sections 529.1541 through 529.1589.

529.1502 Reserved

Operating Limitations

529.1503 Airspeed Limitations: General

(a) An operating speed range shall be established.

(b) When airspeed limitations are a function of weight, weight distribution, altitude, rotor speed, power or other factors, airspeed limitations corresponding with the critical combinations of these factors shall be established.

529.1504 Reserved

529.1505 Never-exceed Speed

(a) The never-exceed speed, V_{NE}, shall be established so that it is:

(1) not less than 40 knots (CAS); and

(2) not more than the lesser of:

(i) 0.9 times the maximum forward speeds established under section 529.309,

(ii) 0.9 times the maximum speed demonstrated under sections 529.251 and 529.629, or

(iii) 0.9 times the maximum speed substantiated for advancing blade tip mach number effects under critical altitude conditions.

(b) V_{NE} may vary with altitude, r.p.m., temperature and weight, if:

(1) no more than two of these variables (or no more than two instruments integrating more than one of these variables) are used at one time; and

(2) the ranges of these variables (or of the indications on instruments integrating more than one of these variables) are large enough to allow an operationally practical and safe variation of V_{NE}.

(c) For helicopters, a stabilized power-off V_{NE} denoted as V_{NE} (power-off) may be established at a speed less than V_{NE} established pursuant to (a) of this section, if the following conditions are met:

(1) V_{NE} (power-off) is not less than a speed midway between the power-on V_{NE} and the speed used in meeting the requirements of:

(i) section 529.67 (a)(3) for Category A helicopters,

(ii) section 529.65 (a) for Category B helicopters, except multi-engine helicopters meeting the requirements of section 529.67 (b), and

(iii) section 529.67 (b) for multi-engine Category B helicopters meeting the requirements of section 529.67 (b);

(2) V_{NE} (power-off) is:

(i) a constant airspeed,

(ii) a constant amount less than power-on V_{NE}, or

(iii) a constant airspeed for a portion of the altitude range for which certification is requested, and a constant amount less than power-on V_{NE} for the remainder of the altitude range.

529.1506 to 529.1508 Reserved

529.1509 Rotor Speed

(a) Maximum power-off (autorotation). The maximum power-off rotor speed shall be established so that it does not exceed 95 percent of the lesser of:

(1) the maximum design r.p.m. determined under section 529.309 (b); and

(2) the maximum r.p.m. demonstrated during the type tests.

(b) Minimum power-off. The minimum power-off rotor speed shall be established so that it is not less than 105 percent of the greater of:

(1) the minimum demonstrated during the type tests; and

(2) the minimum determined by design substantiation.

(c) Minimum power-on. The minimum power-on rotor speed shall be established so that it is:

(1) not less than the greater of:

(i) the minimum demonstrated during the type tests, and

(ii) the minimum determined by design substantiation; and

(2) not more than a value determined under section 529.33 (a)(1) and (c)(1).

529.1510 to 529.1516 Reserved

529.1517 Limiting Height-Speed Envelope

For Category A rotorcraft, if a range of heights exists at any speed, including zero, within which it is not possible to make a safe landing following power failure, the range of heights and its variation with forward speed shall be established, together with any other pertinent information, such as the kind of landing surface.

529.1518 Reserved

529.1519 Weight and Centre of Gravity

The weight and centre of gravity limitations, determined under sections 529.25 and 529.27 respectively, shall be established as operating limitations.

529.1520 Reserved

529.1521 Powerplant Limitations

(a) General. The powerplant limitations prescribed in this section shall be established so that they do not exceed the corresponding limits for which the engines are type certificated.

(b) Take-off operation. The powerplant take-off operation shall be limited by:

(1) the maximum rotational speed which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable manifold pressure (for reciprocating engines);

(3) the maximum allowable turbine inlet or turbine outlet gas temperature (for turbine engines);

(4) the maximum allowable power or torque for each engine, considering the power input limitations of the transmission with all engines operating;

(5) the maximum allowable power or torque for each engine considering the power input limitations of the transmission with one engine inoperative;

(6) the time limit for the use of the power corresponding to the limitations established in (b)(1) through (5) of this section; and

(7) if the time limit established in (b)(6) of this section exceeds 2 minutes:

(i) the maximum allowable cylinder head or coolant outlet temperature (for reciprocating engines), and

(ii) the maximum allowable engine and transmission oil temperatures.

(c) Continuous operation. The continuous operation shall be limited by:

(1) the maximum rotational speed, which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the minimum rotational speed demonstrated under the rotor speed requirements in section 529.1509 (c);

(3) the maximum allowable manifold pressure (for reciprocating engines);

(4) the maximum allowable turbine inlet or turbine outlet gas temperature (for turbine engines);

(5) the maximum allowable power or torque for each engine, considering the power input limitations of the transmission with all engines operating;

(6) the maximum allowable power or torque for each engine, considering the power input limitations of the transmission with one engine inoperative; and

(7) the maximum allowable temperatures for:

(i) the cylinder head or coolant outlet (for reciprocating engines),

(ii) the engine oil, and

(iii) the transmission oil.

(d) Fuel grade or designation. The minimum fuel grade (for reciprocating engines) or fuel designation (for turbine engines) shall be established so that it is not less than that required for the operation of the engines within the limitations prescribed in (b) and (c) of this section.

(e) Ambient temperature. Ambient temperature limitations (including limitations for winterization installations if applicable) shall be established as the maximum ambient atmospheric temperature at which compliance with the cooling provisions of sections 529.1041 through 529.1049 is demonstrated.

(f) 2 minute 30 second-OEI power operation. Unless otherwise authorized, the use of 2 minute 30 second-OEI power shall be limited to engine failure operation of multi-engine, turbine-powered rotorcraft for not longer than 2 minutes 30 seconds for any period in which that power is used. The use of 2 minute 30 second-OEI power shall also be limited by:

(1) the maximum rotational speed, which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable gas temperature;

(3) the maximum allowable torque; and

(4) the maximum allowable oil temperature.

(g) 30 minute-OEI power operation. Unless otherwise authorized, the use of 30 minute-OEI power shall be limited to multi-engine, turbine-powered rotorcraft for not longer than 30 minutes after failure of an engine. The use of 30 minute-OEI power shall also be limited by:

(1) the maximum rotational speed which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable gas temperature;

(3) the maximum allowable torque; and

(4) the maximum allowable oil temperature.

(h) Continuous OEI power operation. Unless otherwise authorized, the use of continuous OEI power shall be limited to multi-engine, turbine-powered rotorcraft for continued flight after failure of an engine. The use of continuous OEI power shall also be limited by:

(1) the maximum rotational speed, which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable gas temperature;

(3) the maximum allowable torque; and

(4) the maximum allowable oil temperature.

(i) Rated 30 second-OEI power operation. Rated 30 second-OEI power is permitted only on multi-engine, turbine-powered rotorcraft, also certificated for the use of rated 2 minute-OEI power, and can only be used for continued operation of the remaining engine(s) after a failure or precautionary shutdown of an engine. It shall be demonstrated that following application of 30 second-OEI power, any damage will be readily detectable by the applicable inspections and other related procedures furnished in accordance with section A529.4 of Appendix A of this chapter and section A533.4 of Appendix A of Chapter 533. The use of 30 second-OEI power shall be limited to not more than 30 seconds for any period in which that power is used, and by:
(amended 1998/10/29)

(1) the maximum rotational speed which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable gas temperature; and

(3) the maximum allowable torque.

(j) Rated 2 minute-OEI power operation. Rated 2 minute-OEI power is permitted only on multi-engine, turbine-powered rotorcraft, also certificated for the use of rated 30 second-OEI power, and can only be used for continued operation of the remaining engine(s) after a failure or precautionary shutdown of an engine. It shall be demonstrated that following application of 2 minute-OEI power, any damage will be readily detectable by the applicable inspections and other related procedures furnished in accordance with section A529.4 of Appendix A of this chapter and section A533.4 of Appendix A of Chapter 533. The use of 2 minute-OEI power shall be limited to not more than 2 minutes for any period in which that power is used, and by:

(1) the maximum rotational speed, which shall not be greater than:

(i) the maximum value determined by the rotor design, or

(ii) the maximum value demonstrated during the type tests;

(2) the maximum allowable gas temperature; and

(3) the maximum allowable torque.

529.1522 Auxiliary Power Unit Limitations

If an auxiliary power unit that meets the requirements of TSO-C77 is installed in the rotorcraft, the limitations established for that auxiliary power unit under the TSO including the categories of operation shall be specified as operating limitations for the rotorcraft.

529.1523 Minimum Flight Crew

The minimum flight crew shall be established so that it is sufficient for safe operation, considering:

(a) the workload on individual crew members;

(b) the accessibility and ease of operation of necessary controls by the appropriate crew member; and

(c) the kinds of operation authorized under section 529.1525.

529.1524 Reserved

529.1525 Kinds of Operation

The kinds of operations (such as VFR, IFR, day, night, or icing) for which the rotorcraft is approved are established by demonstrated compliance with the applicable certification requirements and by the installed equipment.

529.1526 Reserved

529.1527 Maximum Operating Altitude

The maximum altitude up to which operation is allowed, as limited by flight, structural, powerplant, functional, or equipment characteristics, shall be established.

529.1528 Reserved

529.1529 Instructions for Continued Airworthiness

The applicant shall prepare Instructions for Continued Airworthiness in accordance with Appendix A to this Chapter that are acceptable to the Minister. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first rotorcraft or issuance of a standard certificate of airworthiness, whichever occurs later.

529.1530 to 529.1540 Reserved

Markings and Placards

529.1541 General

(a) The rotorcraft shall contain:

(1) the markings and placards specified in sections 529.1545 through 529.1565; and

(2) any additional information, instrument markings, and placards required for the safe operation of the rotorcraft if it has unusual design, operating or handling characteristics.

(b) Each marking and placard prescribed in (a) of this section:

(1) shall be displayed in a conspicuous place; and

(2) shall not be easily erased, disfigured, or obscured.

529.1542 Reserved

529.1543 Instrument Markings: General

For each instrument:

(a) when markings are on the cover glass of the instrument there shall be means to maintain the correct alignment of the glass cover with the face of the dial; and

(b) each arc and line shall be wide enough and located to be clearly visible to the pilot.

529.1544 Reserved

529.1545 Airspeed Indicator

(a) Each airspeed indicator shall be marked as specified in (b) of this section, with the marks located at the corresponding indicated airspeeds.

(b) The following markings shall be made:

(1) a red radial line:

(i) for rotorcraft other than helicopters, at V_{NE}, and

(ii) for helicopters, at V_{NE} (power-on);

(2) a red, cross-hatched radial line at V_{NE} (power-off) for helicopters, if V_{NE} (power-off) is less than V_{NE} (power-on);

(3) for the caution range, a yellow arc;

(4) for the safe operating range, a green arc.

529.1546 Reserved

529.1547 Magnetic Direction Indicator

(a) A placard meeting the requirements of this section shall be installed on or near the magnetic direction indicator.

(b) The placard shall demonstrate the calibration of the instrument in level flight with the engines operating.

(c) The placard shall state whether the calibration was made with radio receiver on or off.

(d) Each calibration reading shall be in terms of magnetic heading in not more than 45° increments.

529.1548 Reserved

529.1549 Powerplant Instruments

For each required powerplant instrument, as appropriate to the type of instruments:

(a) each maximum and, if applicable, minimum safe operating limit shall be marked with a red radial or a red line;

(b) each normal operating range shall be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;

(c) each takeoff and precautionary range shall be marked with a yellow arc or yellow line;

(d) each engine or propeller range that is restricted because of excessive vibration stresses shall be marked with red arcs or red lines; and

(e) each OEI limit or approved operating range shall be marked to be clearly differentiated from the markings of (a) through (d) of this section except that no marking is normally required for the 30-second OEI limit.
(amended 1995/03/25)

529.1550 Reserved

529.1551 Oil Quantity Indicator

Each oil quantity indicator shall be marked with enough increments to indicate readily and accurately the quantity of oil.

529.1552 Reserved

529.1553 Fuel Quantity Indicator

If the unuseable fuel supply for any tank exceeds one gallon, or five percent of the tank capacity, whichever is greater, a red arc shall be marked on its indicator extending from the calibrated zero reading to the lowest reading obtainable in level flight.

529.1554 Reserved

529.1555 Control markings

(a) Each cockpit control, other than primary flight controls or control whose function is obvious, shall be plainly marked as to its function and method of operation.

(b) For powerplant fuel controls:

(1) each fuel tank selector valve control shall be marked to indicate the position corresponding to each tank and to each existing cross feed position;

(2) if safe operation requires the use of any tanks in a specific sequence, that sequence shall be marked on, or adjacent to, the selector for those tanks; and

(3) each valve control for any engine of a multi-engine rotorcraft shall be marked to indicate the position corresponding to each engine controlled.

(c) Useable fuel capacity shall be marked as follows:

(1) for fuel systems having no selector controls, the useable fuel capacity of the system shall be indicated at the fuel quantity indicator;

(2) for fuel systems having selector controls, the useable fuel capacity available at each selector control position shall be indicated near the selector control.

(d) For accessory, auxiliary, and emergency controls:

(1) each essential visual position indicator, such as those demonstrating rotor pitch

or landing gear position, shall be marked so that each crew member can determine at any time the position of the unit to which it relates; and

(2) each emergency control shall be red and shall be marked as to method of operation.

(e) For rotorcraft incorporating retractable landing gear, the maximum landing gear operating speed shall be displayed in clear view of the pilot.

529.1556 Reserved

529.1557 Miscellaneous Markings and Placards

(a) Baggage and cargo compartments, and ballast location. Each baggage and cargo compartment, and each ballast location shall have a placard stating any limitations on contents, including weight, that are necessary under the loading requirements.

(b) Seats. If the maximum allowable weight to be carried in a seat is less than 170 pounds, a placard stating the lesser weight shall be permanently attached to the seat structure.

(c) Fuel and oil filler openings. The following apply:

(1) fuel filler openings shall be marked at or near the filler cover with:

(i) the word “fuel”,

(ii) for reciprocating engine powered rotorcraft, the minimum fuel grade,

(iii) for turbine-engine-powered rotorcraft, the permissible fuel designations. If impractical, this information may be included in the *Rotorcraft Flight Manual*, and the fuel filler may be marked with an appropriate reference to the flight manual, and

(iv) for pressure fuelling systems, the maximum permissible fuelling supply pressure and the maximum permissible defuelling pressure;

(2) oil filler openings shall be marked at or near the filler cover with the word “oil”;

(3) if placards and markings at the fuel or oil opening include tank capacity, the capacity shall be specified in litres. Imperial or U.S. gallons may be included.

Information Note*: No equivalent text is in the FAR.*

(d) Emergency exit placards. Each placard and operating control for each emergency exit shall differ in colour from the surrounding fuselage surface as prescribed in section 529.811 (h)(2). A placard shall be near each emergency exit control and shall clearly indicate the location of that exit and its method of operation.

529.1558 Reserved

529.1559 Limitations Placard

There shall be a placard in a clear view of the pilot that specifies the kinds of operations (VFR, IFR, day, night, or icing) for which the rotorcraft is approved.

529.1560 Reserved

529.1561 Safety Equipment

(a) Each safety equipment control to be operated by the crew in emergency, such as controls for automatic life raft releases, shall be plainly marked as to its method of operation.

(b) Each location, such as a locker or compartment, that carries any fire extinguishing, signalling or other life saving equipment, shall be so marked.

(c) Stowage provisions for required emergency equipment shall be conspicuously marked to identify the contents and facilitate removal of the equipment.

(d) Each life raft shall have obviously marked operating instructions.

(e) Approved survival equipment shall be marked for identification and method of operation.

529.1562 to 529.1564 Reserved

529.1565 Tail Rotor

Each tail rotor shall be marked so that its disc is conspicuous under normal daylight ground conditions.

529.1566 to 529.1580 Reserved

Rotorcraft Flight Manual

529.1581 General

(a) Furnishing information. A *Rotorcraft Flight Manual* shall be furnished with each rotorcraft, and it shall contain the following:

(1) information required by sections 529.1583 through 529.1589; and

(2) other information that is necessary for safe operation because of design, operating, or handling characteristics

(b) Approved information. Each part of the manual listed in sections 529.1583 through 529.1589 that is appropriate to the rotorcraft, shall be furnished, verified and approved, and shall be segregated, identified and clearly distinguished from each unapproved part of that manual.

(c) (Reserved.)

(d) Table of contents. Each *Rotorcraft Flight Manual* shall include a table of contents if the complexity of the manual indicates a need for it.

(e) Removed.
(amended 2003/12/01)

(f) Removed.
(amended 2003/12/01)

529.1582 Reserved

529.1583 Operating Limitations

(a) Airspeed and rotor limitations. Information necessary for the marking of airspeed and rotor limitations on or near their respective indicators shall be furnished. The significance of each limitation and of the colour coding shall be explained.

(b) Powerplant limitations. The following information shall be furnished:

(1) limitations required by section 529.1521;

(2) explanation of the limitations, when appropriate;

(3) information necessary for marking the instruments required by sections 529.1549 through 529.1553.

(c) Weight and loading distribution. The weight and centre of gravity limits required by sections 529.25 and 529.27, respectively, shall be furnished. If the variety of possible loading conditions warrants, instructions shall be included to allow ready observance of the limitations.

(d) Flight crews. When a flight crew of more than one is required, the number and functions of the minimum flight crew determined under section 529.1523 shall be furnished.

(e) Kinds of operation. Each kind of operation for which the rotorcraft and its equipment installations are approved shall be listed.

(f) Limiting heights. Enough information shall be furnished to allow compliance with section 529.1517.

(g) Maximum allowable wind. For Category A rotorcraft, the maximum allowable wind for safe operation near the ground shall be furnished.

(h) Altitude. The altitude established under section 529.1527 and an explanation of the limiting factors shall be furnished.

(i) Ambient temperature. Maximum and minimum ambient temperature limitations shall be furnished.

529.1584 Reserved

529.1585 Operating Procedures

(a) The parts of the manual containing operating procedures shall have information concerning any normal and emergency procedures, and other information necessary for safe operation, including the applicable procedures, such as those involving minimum speeds, to be followed if an engine fails.

(b) For multi-engine rotorcraft, information identifying each operating condition in which the fuel system independence prescribed in section 529.953 is necessary for safety shall be furnished, together with instructions for placing the fuel system in a configuration used to demonstrate compliance with that section.

(c) For helicopters for which a V_{NE} (power-off) is established under section 529.1505(c), information shall be furnished to explain the V_{NE}NE (power-off) and the procedures for reducing airspeed to not more than the V_{NE} (power-off) following failure of all engines.

(d) For each rotorcraft demonstrating compliance with section 529.1353 (c)(6)(ii) or (c)(6)(iii), the operating procedures for disconnecting the battery from its charging source shall be furnished.

(e) If the unuseable fuel supply in any tank exceeds 5 percent of the tank capacity, or 1 gallon, whichever is greater, information shall be furnished which indicates that when the fuel quantity indicator reads “zero” in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(f) Information on the total quantity of useable fuel for each fuel tank shall be furnished.

(g) For Category B rotorcraft, the airspeeds and corresponding rotor speeds for minimum rate of descent and best glide angle as prescribed in section 529.71 shall be provided.

529.1586 Reserved

529.1587 Performance Information

Flight manual performance information which exceeds any operating limitation shall be demonstrated only to the extent necessary for presentation clarity or to determine the effects of approved optional equipment or procedures. When data beyond operating limits are demonstrated, the limits shall be clearly indicated. The following shall be provided:

(a) Category A. For each category A rotorcraft, the *Rotorcraft Flight Manual* must contain a summary of the performance data, including data necessary for the application of any applicable operating rule of the CARs together with descriptions of the conditions, such as airspeeds, under which this data was determined, and must

contain:
(amended 2009/05/11)

(1) the indicated airspeeds corresponding with those determined for take-off, and the procedures to be followed if the critical engine fails during take-off;

(2) the airspeed calibrations;

(3) the techniques, associated airspeeds, and rates of descent for autorotative landings;

(4) the rejected take-off distance determined under section 529.62 and the take-off distance determined under section 529.61 or;
(amended 1999/12/01)

(5) the landing data determined under sections 529.81 or 529.85; and
(amended 1999/12/01)

(6) the steady gradient of climb for each weight, altitude and temperature for which take-off data are to be scheduled, along the take-off path determined in the flight conditions required in section 529.67 (a)(1) and (a)(2):
(amended 1999/12/01)

(i) in the flight conditions required in section 529.67 (a)(1) between the end of the take-off distance and the point at which the rotorcraft is 200 feet above the take-off surface (or 200 feet above the lowest point of the take-off profile for elevated heliports), or

(ii) in the flight conditions required in section 529.67 (a)(2) between the points at which the rotorcraft is 200 and 1000 feet above the take-off surface (or 200 and 1,000 feet above the lowest point of the take-off profile for elevated heliports); and

(7) out-of-ground effect hover performance determined under section 529.49 and the maximum weight for each altitude and temperature condition at which the rotorcraft can safely hover out-of-ground effect in winds of not less than 17 knots from all azimuths. These data must be clearly referenced to the appropriate hover charts;
(amended 2009/05/11)

(b) Category B. For each category B rotorcraft, the *Rotorcraft Flight Manual* must contain:
(amended 2009/05/11)

(1) the take-off distance and the climb out speed together with the pertinent information defining the flight path with respect to autorotative landing if an engine fails, including the calculated effects of altitude and temperature;

(2) the steady rates of climb and in-ground-effect hovering ceiling, together with the corresponding airspeeds and other pertinent information, including the calculated effects of altitude and temperature;

(amended 2009/05/11)

(3) the landing distance, appropriate airspeed, and type of landing surface, together with all pertinent information that might affect this distance, including the effects of weight, altitude and temperature;
(amended 1999/12/01)

(4) the maximum safe wind for operation near the ground;

(5) the airspeed calibrations;

(6) the height-speed envelope except for rotorcraft incorporating this as an operating limitation;

(7) glide distance as a function of altitude when autorotating at the speeds and conditions for minimum rate of descent and best glide angle, as determined in section 529.71;

(8) out-of-ground effect hover performance determined under section 529.49 and the maximum safe wind demonstrated under the ambient conditions for data presented. In addition, the maximum weight for each altitude and temperature condition at which the rotorcraft can safely hover out-of-ground-effect in winds of not less than 17 knots from all azimuths. These data must be clearly referenced to the appropriate hover charts; and
(amended 2009/05/11)

(9) any additional performance data necessary for the application of any operating rule of the CARs.

529.1588 Reserved

529.1589 Loading Information

There shall be loading instructions for each possible loading condition between the maximum and minimum weights determined under section 529.25 that can result in a centre of gravity beyond any extreme prescribed in section 529.27, assuming any probable occupant weights.

(5) the airspeed calibrations;

(6) the height-speed envelope except for rotorcraft incorporating this as an operating limitation;

(7) glide distance as a function of altitude when autorotating at the speeds and conditions for minimum rate of descent and best glide angle, as determined in section 529.71;

(8) out-of-ground effect hover performance determined under section 529.49 and the maximum safe wind demonstrated under the ambient conditions for data presented; and
(amended 1999/12/01)

(9) any additional performance data necessary for the application of any operating rule of the CARs.

529.1588 Reserved

529.1589 Loading Information

There shall be loading instructions for each possible loading condition between the maximum and minimum weights determined under section 529.25 that can result in a centre of gravity beyond any extreme prescribed in section 529.27, assuming any probable occupant weights.

Appendix A
Instructions for Continued Airworthiness

A529.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by section 529.1529.

(b) The Instructions for Continued Airworthiness for each rotorcraft shall include the Instructions for Continued Airworthiness for each engine and rotor (hereinafter designated 'products'), for each appliance required by this Manual or CAR operating requirements and any required information relating to the interface of those appliances and products with the rotorcraft. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the rotorcraft, the Instructions for Continued Airworthiness for the rotorcraft shall include the information essential to the continued airworthiness of the rotorcraft.

(c) The applicant shall submit to the Minister a program to demonstrate how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of products and appliances installed in the rotorcraft will be distributed.

A529.2 Format

(a) The Instructions for Continued Airworthiness shall be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals shall provide for a practical arrangement.

A529.3 Content

The Instructions for Continued Airworthiness shall contain the following manuals or sections, as appropriate, and the following information:

(a) Rotorcraft maintenance manual or section. The rotorcraft maintenance manual or section shall contain the following information:

(1) introduction information that includes an explanation of the rotorcraft's features and data to the extent necessary for maintenance or preventive maintenance;

(2) a description of the rotorcraft and its systems and installations including its engines, rotors, and appliances;

(3) basic control and operation information describing how the rotorcraft components and systems are controlled and how they operate, including any special procedures and limitations that apply;

(4) servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, location of access panels for inspection and servicing, locations of lubrication points, the lubricants to be used, equipment required for servicing, tow instructions and limitations, mooring, jacking and levelling information.

(b) Maintenance Instructions. The Maintenance Instructions shall contain the following information:

(1) scheduling information for each part of the rotorcraft and its engines, auxiliary power units, rotors, accessories, instruments, and equipment that provides the recommended periods at which they should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant demonstrates that the item has an exceptionally high degree of complexity requiring specialized techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross references to the Airworthiness Limitations section of the manual shall also be included. In addition, the applicant shall include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the rotorcraft;

(2) troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions;

(3) information describing the order and method of removing and replacing products and parts with any necessary precautions to be taken;

(4) other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the centre of gravity, lifting and shoring, and storage limitations.

(c) diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided;

(d) details for the application of special inspection techniques including radiographic and ultrasonic testing where such processes are specified;

(e) information needed to apply protective treatments to the structure after inspection;

(f) all data relative to structural fasteners such as identification, discard recommendations, and torque values;

(g) a list of special tools needed.

A529.4 Airworthiness Limitations Section

The Instructions for Continued Airworthiness shall contain a section titled "Airworthiness Limitations" that is segregated and clearly distinguishable from the rest of the document. This section shall set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure approved under section 529.571. If the "Instructions for Continued Airworthiness" consist of multiple documents, the section required by this paragraph shall be included in the principal manual. This section shall contain a legible statement in a prominent location that reads:

"The Airworthiness Limitations section is approved by the Minister and specifies

maintenance required by any applicable airworthiness or operating rule unless an alternative program has been approved by the Minister."

Appendix B
Airworthiness Criteria For Helicopter Instrument Flight

I. General

A transport category helicopter may not be type certificated for operation under the instrument flight rules (IFR) unless it meets the design and installation requirements contained in this Appendix.

II. Definitions

(a) V_{YI} means instrument climb speed, utilized instead of V_Y for compliance with the climb requirements for instrument flight.

(b) V_{NEI} means instrument flight never exceed speed, utilized instead of V_{NE} for compliance with maximum limit speed requirements for instrument flight.

(c) V_{MINI} means instrument flight minimum speed, utilized in complying with minimum limit speed requirements for instrument flight.

III. Trim

It shall be possible to trim the cyclic, collective and directional control forces to zero at all approved IFR airspeeds, power settings and configurations appropriate to the type.

IV. Static Longitudinal Stability

(a) General. The helicopter shall possess positive static longitudinal control force stability at critical combinations of weight and centre of gravity at the conditions specified in paragraphs IV (b) through (f) of this Appendix. The stick force shall vary with speed so that any substantial speed change results in a stick force clearly perceptible to the pilot. The airspeed shall return to within 10 percent of the trim speed when the control force is slowly released for each trim condition specified in paragraphs IV (b) through (f) of this Appendix.

(b) Climb. Stability shall be demonstrated in climb throughout the speed range 20 knots either side of trim with:

(1) the helicopter trimmed at V_{YI};

(2) landing gear retracted (if retractable); and

(3) power required for limit climb rate (at least 1,000 fpm) at V_{YI} or maximum continuous power, whichever is less.

(c) Cruise. Stability shall be demonstrated throughout the speed range from 0.7 to 1.1 V_H or V_{NEI}, whichever is lower, not to exceed ±20 knots from trim with:

(1) the helicopter trimmed and power adjusted for level flight at 0.9 V_H or 0.9 V_{NEI}, whichever is lower; and

(2) landing gear retracted (if retractable).

(d) Slow cruise. Stability shall be demonstrated throughout the speed range from 0.9 V_{MINI} to 1.3 V_{MINI} or 20 knots above trim speed, whichever is greater, with:

(1) the helicopter trimmed and power adjusted for level flight at 1.1 V_{MINI}; and

(2) landing gear retracted (if retractable).

(e) Descent. Stability shall be demonstrated throughout the speed range 20 knots either side of trim with:

(1) the helicopter trimmed at 0.8 V_H or 0.8 V_{NEI} (or 0.8 V_{LE} for the landing gear extended case), whichever is lower;

(2) power required for 1,000 fpm (5.08 m/sec) descent at trim speed; and

(3) landing gear extended and retracted, if applicable.

(f) Approach. Stability shall be demonstrated throughout the speed range from 0.7 times the minimum recommended approach speed to 20 knots above the maximum recommended approach speed with:

(1) the helicopter trimmed at the recommended approach speed or speeds;

(2) landing gear extended and retracted, if applicable; and

(3) power required to maintain a 3° glide path and power required to maintain the steepest approach gradient for which approval is requested.

V. Static Lateral-Directional Stability

(a) Static directional stability must be positive throughout the approved ranges of airspeed, power and vertical speed. In straight and steady sideslips up to ±10° from trim, directional control position must increase without discontinuity with the angle of side-slip, except for a small range of sideslip angles around trim. At greater angles up to the maximum sideslip angle appropriate to the type, increased directional control position must produce an increased angle of sideslip. It must be possible to maintain balanced flight without exceptional pilot skill or alertness.
(amended 2009/05/11)

(b) During sideslips up to ±10° from trim throughout the approved ranges of airspeed, power and vertical speed there must be no negative dihedral stability perceptible to the pilot through lateral control motion or force. Longitudinal cyclic movement with sideslip must not be excessive.
(amended 2009/05/11)

VI. Dynamic Stability

(a) Any oscillation having a period of less than 5 seconds shall damp to 1/2 amplitude in not more than one cycle.

(b) Any oscillation having a period of 5 seconds or more but less than 10 seconds shall damp to 1/2 amplitude in not more than two cycles.

(c) Any oscillation having a period of 10 seconds or more but less than 20 seconds shall be damped.

(d) Any oscillation having a period of 20 seconds or more may not achieve double amplitude in less than 20 seconds.

(e) Any a periodic response may not achieve double amplitude in less than 9 seconds.

VII. Stability Augmentation System (SAS)

(a) If a SAS is used, the reliability of the SAS must be related to the effects of its failure. Any SAS failure condition that would prevent continued safe flight and landing must be extremely improbable. It must be shown that, for any failure condition of the SAS that is not shown to be extremely improbable:
(amended 2009/05/11)

(1) the helicopter is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved IFR operating limitations; and
(amended 2009/05/11)

(2) the overall flight characteristics of the helicopter allow for prolonged instrument flight without undue pilot effort. Additional unrelated probable failures affecting the control system must be considered. In addition:
(amended 2009/05/11)

(i) The controllability and manoeuvrability requirements in Subchapter B must be met throughout a practical flight envelope;
(amended 2009/05/11)

(ii) The flight control, trim, and dynamic stability characteristics must not be impaired below a level needed to allow continued safe flight and landing;
(amended 2009/05/11)

(iii) For Category A helicopters, the dynamic stability requirements of Subchapter B must also be met throughout a practical flight envelope; and
(amended 2009/05/11)

(iv) The static longitudinal and static directional stability requirements of Subchapter B must be met throughout a practical flight envelope.
(amended 2009/05/11)

(b) The SAS shall be designed so that it cannot create a hazardous deviation in flight path or produce hazardous loads on the helicopter during normal operation or in the event of malfunction of failure, assuming corrective action begins within an appropriate period of time. Where multiple systems are installed, subsequent malfunction conditions shall be considered in sequence unless their occurrence is shown to be improbable.

VIII. Equipment, Systems, and Installation

The basic equipment and installation shall comply with the *Federal Aviation Regulation* (U.S.) Subpart F of Part 29 through Amendment 29-14, with the following exceptions and

additions:

(a) Flight and navigation instruments. The following modifications apply:

(1) A magnetic gyro-stabilized direction indicator instead of the gyroscopic direction indicator required by 529.1303 (h); and

(2) A standby attitude indicator which meets the requirements of 529.1303 (g)(1) through (7), instead of a rate-of-turn indicator required by 529.1303 (g). If standby batteries are provided, they may be charged from the aircraft electrical system if adequate isolation is incorporated. The system shall be designed so that the standby batteries may not be used for engine starting.

(b) Miscellaneous requirements. The following modifications apply:

(1) instrument systems and other systems essential for IFR flight that could be adversely affected by icing shall be provided with adequate ice protection whether or not the rotorcraft is certificated for operation in icing conditions;

(2) there shall be means in the generating system to automatically de-energize and disconnect from the main bus any power source developing hazardous overvoltage;

(3) each required flight instrument using a power supply (electric, vacuum, etc.) shall have a visual means integral with the instrument to indicate the adequacy of the power being supplied;

(4) when multiple systems performing like functions are required, each system shall be grouped, routed, and spaced so that physical separation between systems is provided to ensure that a single malfunction will not adversely affect more than one system;

(5) for systems that operate the required flight instruments at each pilot's station:

(i) only the required flight instruments for the first pilot may be connected to that operating system,

(ii) additional instruments, systems, or equipment may not be connected to an operating system for a second pilot unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any malfunction of the additional instruments, systems or equipment which is not shown to be extremely improbable,

(iii) the equipment, systems and installations shall be designed so that one display of the information essential to the safety of flight which is provided by the instruments will remain available to a pilot, without additional crew member action, after any single failure or combination of failures that is not shown to be extremely improbable, and

(iv) for single-pilot configurations, instruments which require a static source shall be provided with a means of selecting an alternate source and that source shall be calibrated;

(6) in determining compliance with the requirements of section 529.1351 (d)(2), the supply of electrical power to all systems necessary for flight under IFR shall be included in the evaluation.
(amended 1997/04/07)

(c) Thunderstorm lights. In addition to the instrument lights required by 529.1381 (a), thunderstorm lights which provide high intensity white flood lighting to the basic flight instruments shall be provided. The thunderstorm lights shall be installed to meet the requirements of section 529.1381 (b).

IX. *Rotorcraft Flight Manual*

A *Rotorcraft Flight Manual* or Rotorcraft Flight Manual IFR Supplement shall be provided and shall contain:

(a) Limitations. The approved IFR flight envelope, the IFR flight crew composition, the revised kinds of operation, and the steepest IFR precision approach gradient for which the helicopter is approved;

(b) Procedures. Required information for proper operation of IFR systems and the recommended procedures in the event of stability augmentation or electrical system failures; and

(c) Performance. If V_{YI} differs from V_Y, climb performance at V_{YI} and with maximum continuous power throughout the ranges of weight, altitude and temperature for which approval is requested.

Appendix C
Icing Certification

(a) Continuous maximum icing. The maximum continuous intensity of atmospheric icing conditions (continuous maximum icing) is defined by the variables of the cloud liquid water content, the mean effective diameter of the cloud droplets, the ambient air temperature, and the interrelationship of these three variables as shown in Figure 1 of this Appendix. The limiting icing envelope in terms of altitude and temperature is given in Figure 2 of this Appendix. The interrelationship of cloud liquid water content with drop diameter and altitude is determined from Figures 1 and 2. The cloud liquid water content for continuous maximum icing conditions of a horizontal extent, other than 17.4 nautical miles (32 225 km), is determined by the value of liquid water content of Figure 1, multiplied by the appropriate factor from Figure 3 of this Appendix.

(b) Intermittent maximum icing. The intermittent maximum intensity of atmospheric icing conditions (intermittent maximum icing) is defined by the variables of the cloud liquid water content, the mean effective diameter of the cloud droplets, the ambient air temperature, and the interrelationship of these three variables as shown in Figure 4 of this Appendix. The limiting icing envelope in terms of altitude and temperature is given in Figure 5 of this Appendix. The interrelationship of cloud liquid water content with drop diameter and altitude is determined from Figures 4 and 5. The cloud liquid water content for intermittent maximum icing conditions of a horizontal extent, other than 2.6 nautical miles (4 815 km) , is determined by the value of cloud liquid water content of Figure 4 multiplied by the appropriate factor in Figure 6 of this Appendix.

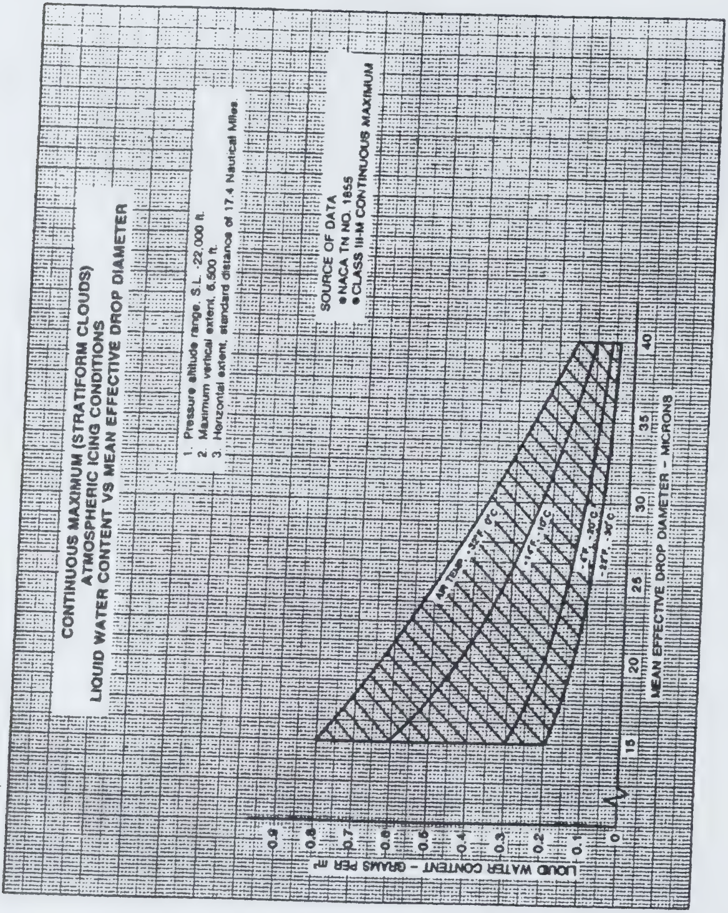

CONTINUOUS MAXIMUM (STRATIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
LIQUID WATER CONTENT VS MEAN EFFECTIVE DROP DIAMETER
1. Pressure altitude range, S.L. -22,000 ft.
2. Maximum vertical extent, 6,500 ft.
3. Horizontal extent, standard distance of 17.4 Nautical Miles.
SOURCE OF DATA
• NACA TN NO. 1855
• CLASS III-M CONTINUOUS MAXIMUM
AIR TEMP.
+14°F, -10°C
-4°F, -20°C
-22°F, -30°C
LIQUID WATER CONTENT – GRAMS PER m³
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
15
20
25
30
35
40
MEAN EFFECTIVE DROP DIAMETER – MICRONS

FIGURE 1

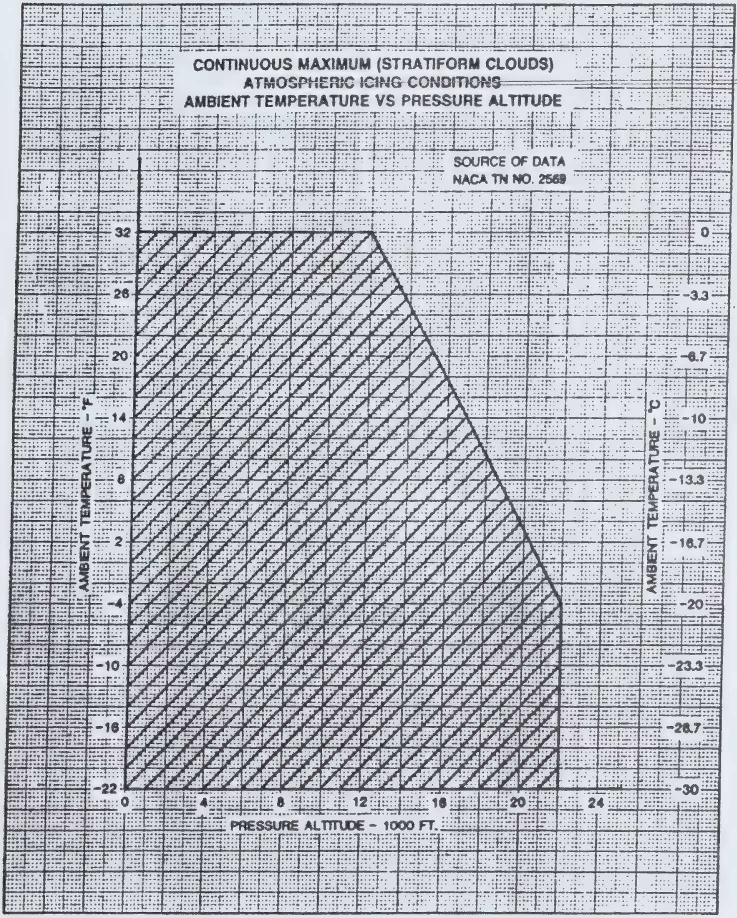

CONTINUOUS MAXIMUM (STRATIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
AMBIENT TEMPERATURE VS PRESSURE ALTITUDE
SOURCE OF DATA
NACA TN NO. 2569
AMBIENT TEMPERATURE – °F
32
26
20
14
8
2
-4
-10
-16
-22
AMBIENT TEMPERATURE – °C
0
-3.3
-6.7
-10
-13.3
-16.7
-20
-23.3
-26.7
-30
0
4
8
12
16
20
24
PRESSURE ALTITUDE – 1000 FT.

FIGURE 2

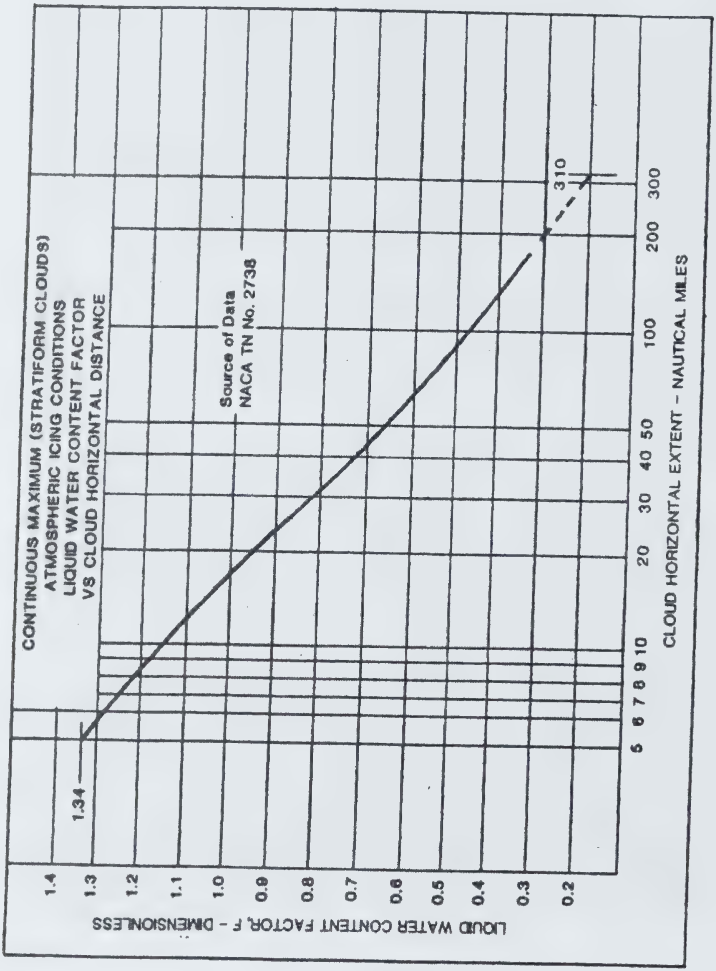

CONTINUOUS MAXIMUM (STRATIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
LIQUID WATER CONTENT FACTOR
VS CLOUD HORIZONTAL DISTANCE
Source of Data
NACA TN No. 2738
1.34
310
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
LIQUID WATER CONTENT FACTOR, F – DIMENSIONLESS
5
6
7
8
9
10
20
30
40
50
100
200
300
CLOUD HORIZONTAL EXTENT – NAUTICAL MILES

FIGURE 3

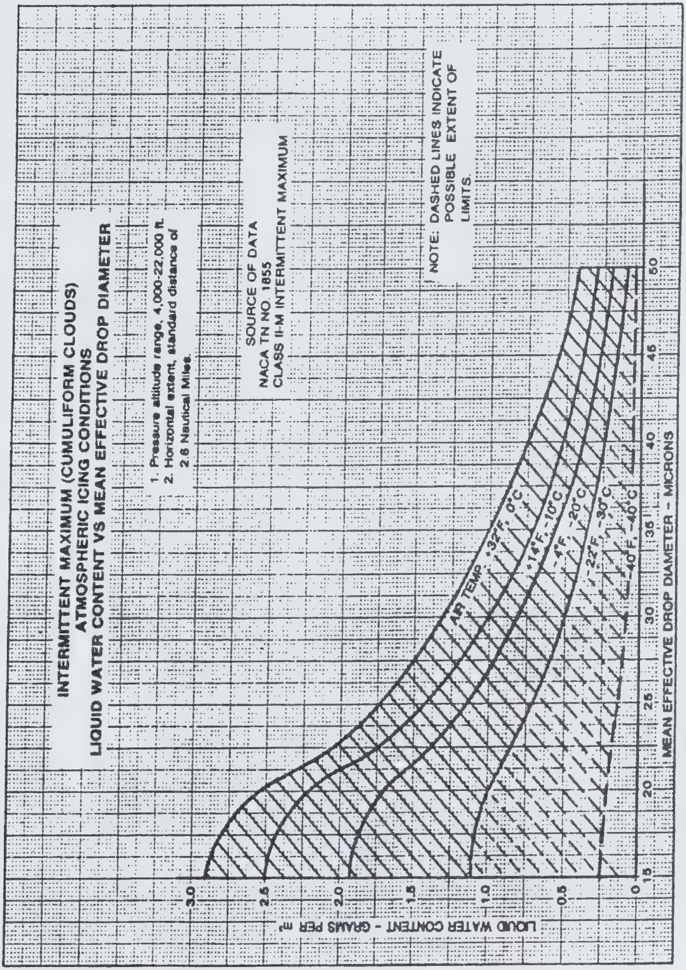

INTERMITTENT MAXIMUM (CUMULIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
LIQUID WATER CONTENT VS MEAN EFFECTIVE DROP DIAMETER
1. Pressure altitude range, 4,000-22,000 ft.
2. Horizontal extent, standard distance of 2.6 Nautical Miles.
SOURCE OF DATA
NACA TN NO. 1855
CLASS II-M INTERMITTENT MAXIMUM
NOTE: DASHED LINES INDICATE POSSIBLE EXTENT OF LIMITS.
AIR TEMP. +32°F, 0°C
+14°F, -10°C
-4°F, -20°C
-22°F, -30°C
-40°F, -40°C
LIQUID WATER CONTENT - GRAMS PER m³
3.0
2.5
2.0
1.5
1.0
0.5
0
15
20
25
30
35
40
45
50
MEAN EFFECTIVE DROP DIAMETER - MICRONS

FIGURE 4

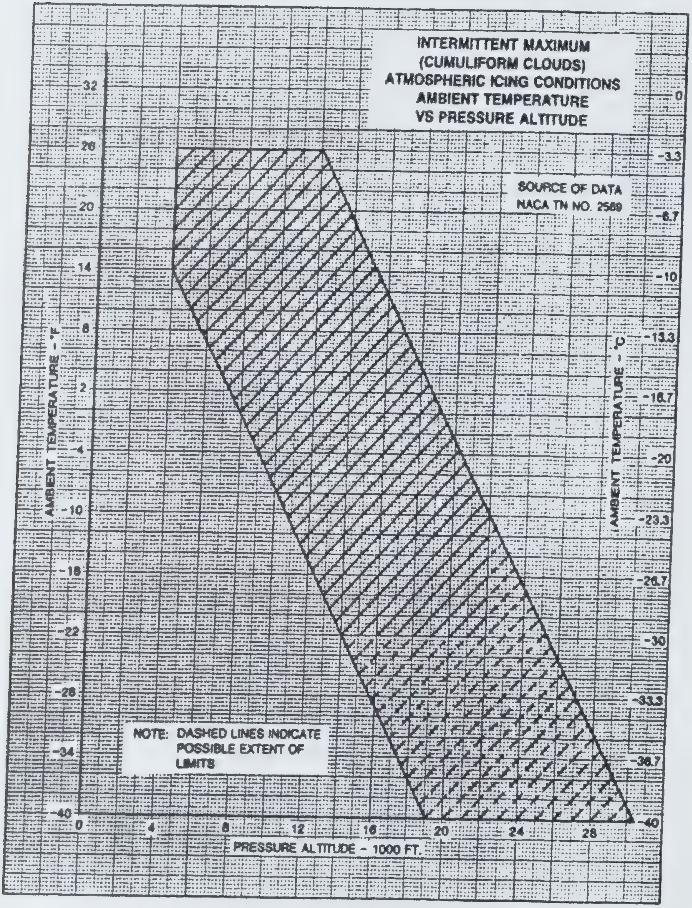

INTERMITTENT MAXIMUM
(CUMULIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
AMBIENT TEMPERATURE
VS PRESSURE ALTITUDE
SOURCE OF DATA
NACA TN NO. 2569
NOTE: DASHED LINES INDICATE POSSIBLE EXTENT OF LIMITS
AMBIENT TEMPERATURE – °F
32
26
20
14
8
2
-4
-10
-16
-22
-28
-34
-40
AMBIENT TEMPERATURE – °C
0
-3.3
-6.7
-10
-13.3
-16.7
-20
-23.3
-26.7
-30
-33.3
-36.7
-40
PRESSURE ALTITUDE – 1000 FT.
0
4
8
12
16
20
24
28

FIGURE 5

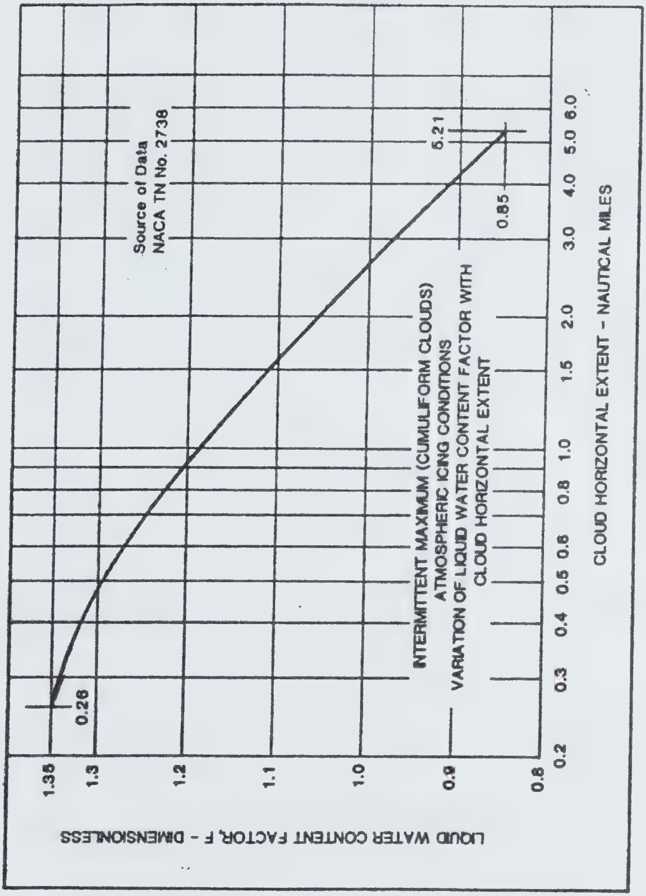

LIQUID WATER CONTENT FACTOR, F - DIMENSIONLESS
1.35
1.3
1.2
1.1
1.0
0.9
0.8
0.2
0.3
0.4
0.5
0.6
0.8
1.0
1.5
2.0
3.0
4.0
5.0
6.0
CLOUD HORIZONTAL EXTENT - NAUTICAL MILES
0.26
5.21
0.85
Source of Data
NACA TN No. 2738
INTERMITTENT MAXIMUM (CUMULIFORM CLOUDS)
ATMOSPHERIC ICING CONDITIONS
VARIATION OF LIQUID WATER CONTENT FACTOR WITH
CLOUD HORIZONTAL EXTENT

FIGURE 6

Appendix D
Criteria for Demonstration of Emergency Evacuation Procedures under 529.803

(a) The demonstration shall be conducted either during the dark of the night or during daylight with the dark of night simulated. If the demonstration is conducted indoors during daylight hours, it shall be conducted inside a darkened hangar having doors and windows covered. In addition, the doors and windows of the rotorcraft shall be covered if the hangar illumination exceeds that of a moonless night. Illumination on the floor or ground may be used, but it shall be kept low and shielded against shining into the rotorcraft's windows or doors.

(b) The rotorcraft shall be in a normal attitude with landing gear extended.

(c) Safety equipment such as mats or inverted life rafts may be placed on the floor or ground to protect participants. No other equipment that is not part of the rotorcraft's emergency evacuation equipment may be used to aid the participants in reaching the ground.

(d) Except as provided in paragraph (a) of this Appendix, only the rotorcraft's emergency lighting system may provide illumination.

(e) All emergency equipment required for the planned operation of the rotorcraft shall be installed.

(f) Each external door and exit and each internal door or curtain shall be in the take-off configuration.

(g) Each crew member shall be seated on the normally assigned seat for take-off and shall remain in that seat until receiving the signal for commencement of the demonstration. For compliance with this section, each crew member shall be:

(1) a member of a regularly scheduled line crew; or

(2) a person having knowledge of the operation of exits and emergency equipment.

(h) A representative passenger load of persons in normal health shall be used as follows:

(1) at least 25 percent shall be over 50 years of age, with at least 40 percent of these being females;

(2) the remaining 75 percent or less, shall be 50 years of age or younger, with at least 30 percent of these being females;

(3) three life-size dolls, not included as part of the total passenger load, shall be carried by passengers to simulate live infants 2 years old or younger, except for a total passenger load of fewer than 44 but more than 19, one doll shall be carried. A doll is not required for a 19 or fewer passenger load;

(4) crew members, mechanics and training personnel who maintain or operate the rotorcraft in the normal course of their duties may not be used as passengers.

(i) No passenger may be assigned a specific seat except as the Minister may require. Except as required by paragraph (g)(1) of this appendix, no employee of the applicant may be seated next to an emergency exit, except as allowed by the Minister.

(j) Seat belts and shoulder harnesses (as required) shall be fastened.

(k) Before the start of the demonstration, approximately one-half of the total average amount of carry-on baggage, blankets, pillows and other similar articles shall be distributed at several locations in the aisles and emergency exit access ways to create minor obstructions.

(l) No prior indication may be given to any crew member or passenger of the particular exits to be used in the demonstration.

(m) The applicant may not practice, rehearse or describe the demonstration for the participants nor may any participant have taken part in this type of demonstration within the preceding 6 months.

(n) A pretake-off passenger briefing may be given. The passengers may also be advised to follow directions of crew members, but not be instructed on the procedures to be followed in the demonstration.

(o) If safety equipment, as allowed by paragraph (c) of this appendix, is provided, either all passenger and cockpit windows shall be blacked out or all emergency exits shall have safety equipment to prevent disclosure of the available emergency exits.

(p) Not more than 50 percent of the emergency exits in the sides of the fuselage of a rotorcraft that meet all of the requirements applicable to the required emergency exits for that rotorcraft may be used for demonstration. Exits that are not to be used for the demonstration shall have the exit handle deactivated or shall be indicated by red lights, red tape, or other acceptable means placed outside the exits to indicate fire or other reasons why they are unuseable. The exits to be used shall be representative of all the emergency exits on the rotorcraft and shall be designated by the applicant, subject to approval by the Minister. If installed, at least one floor level exit (Type I; 529.807 (a)(1) shall be used as required by section 529.807 (c).

(q) All evacuees shall leave the rotorcraft by a means provided as part of the rotorcraft's equipment.

(r) Approved procedures shall be fully utilized during the demonstration.

(s) The evacuation time period is completed when the last occupant has evacuated the rotorcraft and is on the ground.

Appendix E
HIRF Environments and Equipment HIRF Test Levels
(amended 2008/10/30)

This appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems in accordance with 529.1317. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square units (RMS) measured during the peak of the modulation cycle.
(amended 2008/10/30)

(a) HIRF environment I is specified in the following table:
(amended 2008/10/30)

Table I — HIRF Environment I

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	50	50
100 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2000	200
2 GHz – 6 GHz	3000	200
6 GHz – 8 GHz	1000	200
8 GHz – 12 GHz	3000	300
12 GHz – 18 GHz	2000	200
18 GHz – 40 GHz	600	200
In this table, the higher field strength applies at the frequency band edges		
		(amended 2008/10/30)

(b) HIRF environment II is specified in the following table:
(amended 2008/10/30)

Table II — HIRF Environment II

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 500 kHz	20	20
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1300	160
2 GHz – 4 GHz	3000	120
4 GHz – 6 GHz	3000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150
In this table, the higher field strength applies at the frequency band edges		
		(amended 2008/10/30)

(c) HIRF environment III is specified in the following table.
(amended 2008/10/30)

Table III — HIRF Environment III

Frequency	Field Strength (Volts/Meter)	
	Peak	Average
10 kHz – 100 kHz	150	150
100 kHz – 400 MHz	200	200
400 MHz – 700 MHz	730	200
700 MHz – 1 GHz	1400	240
1 GHz – 2 GHz	5000	250
2 GHz – 4 GHz	6000	490

4 GHz – 6 GHz	7200	400
6 GHz – 8 GHz	1100	170
8 GHz – 12 GHz	5000	330
12 GHz – 18 GHz	2000	330
18 GHz – 40 GHz	1000	420
In this table, the higher field strength applies at the frequency band edges		
(amended 2008/10/30)		

(d) Equipment HIRF Test Level 1
(amended 2008/10/30)

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with continuous wave (CW) and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current shall start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibel (dB) per frequency decade to a minimum of 30 mA at 500 kHz.
(amended 2008/10/30)

(2) From 500 kHz to 40 MHz, the conducted susceptibility current shall be at least 30 mA.
(amended 2008/10/30)

(3) From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 30 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 3 mA at 400 MHz.
(amended 2008/10/30)

(4) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/m) peak with CW and 1 kHz square wave modulation with 90 percent depth or greater.
(amended 2008/10/30)

(5) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal shall be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.
(amended 2008/10/30)

(e) Equipment HIRF Test Level 2
(amended 2008/10/30)

Equipment HIRF test level 2 is HIRF environment II in table II of this appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing shall cover the frequency band of 10 kHz to 8 GHz.
(amended 2008/10/30)

(f) Equipment HIRF Test Level 3
(amended 2008/10/30)

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 7.5 mA at 500 kHz.
(amended 2008/10/30)

(2) From 500 kHz to 40 MHz, use conducted susceptibility tests at a minimum of 7.5 mA.
(amended 2008/10/30)

(3) From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 7.5 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 0.75 mA at 400 MHz.
(amended 2008/10/30)

(4) From 100 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 5 V/m.
(amended 2008/10/30)

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 531 - MANNED FREE BALLOONS

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa, Ontario
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51-15/531-2009E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2009-2 ([illegible] 2/02)	2012/03/[illegible]	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL
CHAPTER 531 - MANNED FREE BALLOONS

Table of Contents

[Interpretation Provision for Part V Standards

[In these Standards:

[*(a)* The passages giving the Minister power to determine, approve or authorise something without stating criteria for the use of such power are to be interpreted as requiring that the power be used in consideration of two factors only: the airworthiness of the aircraft that is the subject of the determination, approval or authorisation, or on which an aeronautical product that is the subject of the determination, approval or authorisation is to be installed, and the aircraft's level of safety;

[*(b)* The word "approved", when used without any indication of a method of approval, is to be interpreted as referring to an approval granted under the *Aeronautics Act*.]

Preamble

General

The content of this chapter is based on the United States Code of Federal Regulations, Title 14, Chapter I, Part 31 entitled Airworthiness Standards, Manned Free Balloons. These United States airworthiness standards have been used and adapted as the model for the Canadian standards supplemented by additional airworthiness requirements based on Canadian experience and required for Canadian aviation purposes.

The FAR numbering system is used. The Canadian standards bear the same number as the FAR equivalent, prefixed by the number "5", as this chapter contains the standards for Part V of the *Canadian Aviation Regulations* (CARs).

* * * * * * * * * * * * *

First Edition **Effective: January 1, 1986**

The standards in this chapter are presented in a two column format with the United States FAR in the left column and the Canadian standards in the right column. Chapters, sub-chapters, sections and subsections numbering and headings are opposite to the equivalent FAR. Where the Canadian standard is identical to the FAR, the words "No Variation" appear; where a variation exists, the affected part of text is printed opposite to the FAR with all changes underlined.

The first edition of this chapter is based on FAR Part 31, up to and including amendment 31-4. In addition to administrative changes (e.g., Administrator = Minister; Part = Chapter) and the deletion of references to operating FARs, the Canadian variations included in this edition are as follows:

(1) 531.81 General: *(c)* Units; and

(d) Operating Rules

* * * * * * * * * * * * *

Change 531-1 **Effective: June 1, 1991**

This change incorporates Amendment 31-5 to the United States Code of Federal Regulations, Title 14, Chapter I, Part 31 published in the Federal Register dated August 18, 1989. This amendment changes a cross reference to Part 91 in Appendix A of Part 31 and as such it is not applicable in Canada. This FAR change is part of a larger reorganisation of the general U.S. operating and flight rules to make them more understandable and easier to use.

In addition, section 531.1 has been rewritten to refer to the Air Regulation enabling the type approval of aeronautical products.

Note: Changes are identified by "[ ]" brackets. Editorial changes are not identified.

* * * * * * * * * * * *

Second Edition **Effective: 7 April 1997**

Change 531-2

With the incorporation of this change, the entire chapter, including all the associated advisory material (AMAs), is republished in a Second Edition. The chapter is presented in a new format common to the versions made available on the Internet and CD Rom.

This change introduces a new format such as the removal of the left-hand column containing the FARs. The Canadian standards in this chapter are now presented in a full-page format. Canadian variations from the FARs are underlined with the FAR text following in a shaded box. The amendment number and date of affected pages has been removed from the bottom of the page. Instead, affected *sections* will be followed by amendment numbers and dates of current changes as well as any previous changes.

This amendment incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 31 published in the Federal Register dated 24 May, 1996:

* Amendment 31-7 "Manned Free Balloon Burner Testing" amends the burner test requirements to test the burner's most critical operating conditions under more realistic simulation of actual flight conditions. These changes increase the safety level and at the same time reduce the fuel costs to balloon manufacturers seeking certification. The adoption of this amendment has been subjected to consultation with the Canadian aviation industry through NPA 96-06 dated 2 December 1996.

Information Notes:

1. Amendment 31-6, which is for the revision of the U.S. authority citation, is not applicable in Canada.

2. The Enabling authority has been replaced by the reference to the Canadian Aviation Regulations *in subsection 531.1(a).*

Change 531-3 **Published: 1 December 2009**

On December 1, 2009, Part V Subpart 21 of the Canadian Aviation Regulations (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends section 531.1 to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

AIRWORTHINESS MANUAL CHAPTER 531 - MANNED FREE BALLOONS

SUBCHAPTER A
GENERAL

531.1 *Applicability*

(a) This Chapter sets out airworthiness standards for the issue of type certificates and changes to type certificates, for manned free balloons categories.

(b) Reserved.
(amended 2009/12/01)

(c) For the purposes of this chapter:

(1) A captive gas balloon is a balloon that derives its lift from a captive lighter-than-air gas;

(2) A hot air balloon is a balloon that derives its lift from heated air;

(3) The envelope is the enclosure in which the lifting means is contained;

(4) The basket is the container, suspended beneath the envelope, for the balloon occupants;

(5) The trapeze is a harness or is a seat consisting of a horizontal bar or platform suspended beneath the envelope for the balloon occupants; and

(6) The design maximum weight is the maximum total weight of the balloon, less the lifting gas or air.

(Change 531-1 (91-06-01))

(Change 531-2 (97-04-07))

SUBCHAPTER B
FLIGHT REQUIREMENTS

531.11 *Reserved*

531.12 *Proof of Compliance*

(a) Each requirement of this subchapter must be met at each weight within the range of loading conditions for which certification is requested. This must be shown by:

(1) Tests upon a balloon of the type for which certification is requested or by calculations based on, and equal in accuracy to, the results of testing; and

(2) Systematic investigation of each weight if compliance cannot be reasonably inferred from the weights investigated.

(b) Except as provided in 531.17(b), allowable weight tolerances during flight testing are +5% and -10%.

531.14 *Weight limits*

(a) The range of weights over which the balloon may be safely operated must be established.

(b) Maximum weight. The maximum weight is the highest weight at which compliance with each applicable requirement of this chapter is shown. The maximum weight must be established so that it is not more than:

(1) The highest weight selected by the applicant;

(2) The design maximum weight which is the highest weight at which compliance with each applicable structural loading condition of this chapter is shown; or

(3) The highest weight at which compliance with each applicable flight requirement of this chapter is shown.

(c) The information established under paragraphs (a) and (b) of this section must be made available to the pilot in accordance with 531.81.

531.16 *Empty Weight*

The empty weight must be determined by weighing the balloon with installed equipment but without lifting gas or heater fuel.

531.17 *Performance: Climb*

(a) Each balloon must be capable of climbing at least 300 ft (91.5m) in the first minute after takeoff with a steady rate of climb. Compliance with the requirements of this section must be shown at each altitude and ambient temperature for which approval is sought.

(b) Compliance with the requirements of paragraph (a) of this section must be shown at the maximum weight with a weight tolerance of +5%.

531.19 *Performance: Uncontrolled Descent*

(a) The following must be determined for the most critical uncontrolled descent that can result from any single failure of the heater assembly, fuel cell system, gas valve system, or manoeuvring vent system, or from any single tear in the balloon envelope between tear stoppers:

(1) The maximum vertical velocity attained.

(2) The altitude loss from the point of failure to the point at which maximum vertical velocity is attained.

(3) The altitude required to achieve level flight after corrective action is initiated, with the balloon descending at the maximum vertical velocity determined in paragraph (a)(1) of this section.

(b) Procedures must be established for landing at the maximum vertical velocity determined in paragraph (a)(1) of this section and for arresting that descent rate in accordance with paragraph (a)(3) of this section.

531.20 *Controllability*

The applicant must show that the balloon is safely controllable and manoeuvrable during takeoff, ascent, descent, and landing without requiring exceptional piloting skill.

SUBCHAPTER C
STRENGTH REQUIREMENTS

531.21 *Loads*

Strength requirements are specified in terms of limit loads, that are the maximum load to be expected in service, and ultimate loads, that are limit loads multiplied by prescribed factors of safety. Unless otherwise specified, all prescribed loads are limit loads.

531.23 *Flight Load Factor*

In determining limit load, the limit flight load factor must be at least 1.4.

531.25 *Factor of Safety*

(a) Except as specified in paragraphs (b) and (c) of this section, the factor of safety is 1.5.

(b) A factor of safety of a least five must be used in envelope design. A reduced factor of safety of at least two may be used if it is shown that the selected factor will preclude failure due to creep or instantaneous rupture from lack of rip stoppers. The selected factor must be applied to the more critical of the maximum operating pressure or envelope stress.

(c) A factor of safety of at least five must be used in the design of all fibrous or non-metallic parts of the rigging and related attachments of the envelope to basket, trapeze, or other means provided for carrying occupants. The primary attachments of the envelope to the basket, trapeze, or other means provided for carrying occupants must be designed so that failure is extremely remote or so that any single failure will not jeopardise safety of flight.

(d) In applying factors of safety, the effect of temperature, and other operating characteristics, or both, that may affect strength of the balloon must be accounted for.

(e) For design purposes, an occupant weight of at least 170 lbs (756 N) must be assumed.

531.27 *Strength*

(a) The structure must be able to support limit loads without detrimental effect.

(b) The structure must be substantiated by test to be able to withstand the ultimate loads for at least three seconds without failure. For the envelope, a test of a representative part is acceptable, if the part tested is large enough to include critical seams, joints, and load attachment points and members.

(c) An ultimate free-fall drop test must be made of the basket, trapeze, or other place provided for occupants. The test must be made at design maximum weight on a horizontal surface, with the basket, trapeze, or other means provided for carrying occupants, striking the surface at angles of 0, 15, and 30 degrees. The weight may be distributed to simulate actual conditions. There must be no distortion or failure that is likely to cause serious injury to the occupants. A drop test height of 36 inches (91,5 cm), or a drop test height that produces, upon impact, a velocity equal to the maximum vertical velocity determined in accordance with 531.19, whichever is higher, must be used.

SUBCHAPTER D
DESIGN AND CONSTRUCTION

531.31 *General*

The suitability of each design detail or part that bears on safety must be established by tests or analysis.

531.33 *Materials*

(a) The suitability and durability of all materials must be established on the basis of experience or tests. Materials must conform to approved specifications that will ensure that they have the strength and other properties assumed in the design data.

(b) Material strength properties must be based on enough tests of material conforming to specifications so as to establish design values on a statistical basis.

531.35 *Fabrication Methods*

The methods of fabrication used must produce a consistently sound structure. If a fabrication process requires close control to reach this objective, the process must be performed in accordance with an approved process specification.

531.37 *Fastenings*

Only approved bolts, pins, screws, and rivets may be used in the structure. Approved locking devices or methods must be used for all these bolts, pins, and screws, unless the installation is shown to be free from vibration. Self-locking nuts may not be used on bolts that are subject to rotation in service.

531.39 *Protection*

Each part of the balloon must be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, or other causes.

531.41 *Inspection Provisions*

There must be a means to allow close examination of each part that requires repeated inspection and adjustment.

531.43 *Fitting Factor*

(a) A fitting factor of at least 1.15 must be used in the analysis of each fitting the strength of which is not proven by limit and ultimate load tests in which the actual stress conditions are simulated in the fitting and surrounding structure. This factor applies to all parts of the fitting, the means of attachment, and the bearing on the members joined.

(b) Each part with an integral fitting must be treated as a fitting up to the point where the section properties become typical of the member.

(c) The fitting factor need not be used if the joint design is made in accordance with approved practices and is based on comprehensive test data.

531.45 *Fuel Cells*

If fuel cells are used, the fuel cells, their attachments, and related supporting structure must be shown by tests to be capable of withstanding, without detrimental distortion or failure, any inertia loads to which the installation may be subjected, including the drop tests prescribed in 531.27(c). In the tests, the fuel cells must be loaded to the weight and pressure equivalent to the full fuel quantity condition.

531.46 *Pressurised Fuel Systems*

For pressurised fuel systems, each element and its connecting fittings and lines must be tested to an ultimate pressure of at least twice the maximum pressure to which the system will be subjected in normal operation. No part of the system may fail or malfunction during the test. The test configuration must be representative of the normal fuel system installation and balloon configuration.

531.47 *[Burners*

(a) [If a burner is used to provide the lifting means, the system must be designed and installed so as not to create a fire hazard.

(b) There must be shielding to protect parts adjacent to the burner flame, and the occupants, from heat effects.

(c) There must be controls, instruments, or other equipment essential to the safe control and operation of the heater. They must be shown to be able to perform their intended functions during normal and emergency operation.

(d) [The burner system (including the burner unit, controls, fuel lines, fuel cells, regulators, control valves, and other related elements) must be substantiated by an endurance test of at least 40 hours. Each element of the system must be installed and tested to simulate actual balloon installation and use.

[(1) The test program for the main blast valve operation of the burner must include:

[(i) Five hours at the maximum fuel pressure for which approval is sought, with a burn time for each one minute cycle of three to ten seconds. The burn time must be established so that each burner is subjected to the maximum thermal shock for temperature affected elements;

[(ii) Seven and one-half hours at an intermediate fuel pressure, with a burn time for each one minute cycle of three to ten seconds. An intermediate fuel pressure is 40 to

60 percent of the range between the maximum fuel pressure referenced in paragraph (d)(1)(i) of this section and minimum fuel pressure referenced in paragraph (d)(1)(iii);

[(iii) Six hours and fifteen minutes at the minimum fuel pressure for which approval is sought, with a burn time for each one minute cycle of three to ten seconds;

[(iv) Fifteen minutes of operation on vapour, with a burn time for each one minute cycle of at least 30 seconds; and

[(v) Fifteen hours of normal flight operation.

[(2) The test program for the secondary or backup operation of the burner must include six hours of operation with a burn time for each five minute cycle of one minute at an intermediate fuel pressure.]

(e) The test must also include at least three flameouts and restarts.

(f) Each element of the system must be serviceable at the end of the test.

(Change 531-2 (97-04-07))

531.49 *Control Systems*

(a) Each control must operate easily, smoothly, and positively enough to allow proper performance of its functions. Controls must be arranged and identified to provide for convenience of operation and to prevent the possibility of confusion and subsequent inadvertent operation.

(b) Each control system and operating device must be designed and installed in a manner that will prevent jamming, chafing, or interference from passengers, cargo, or loose objects. Precaution must be taken to prevent foreign objects from jamming the controls. The elements of the control system must have design features or must be distinctly and permanently marked to minimise the possibility of incorrect assembly that could result in malfunctioning of the control system.

(c) Each balloon using a captive gas as the lifting means must have an automatic valve or appendix that is able to release gas automatically at the rate of at least 3% of the total volume per minute when the balloon is at its maximum operating pressure.

(d) Each hot air balloon must have a means to allow the controlled release of hot air during flight.

(e) Each hot air balloon must have a means to indicate the maximum envelope skin temperature occurring during operation. The indicator must be readily visible to the pilot and marked to indicate the limiting safe temperature of the envelope material. If the markings are on the cover glass of the instrument, there must be provisions to maintain the correct alignment of the glass cover with the face of the dial.

531.51 *Ballast*

Each captive gas balloon must have a means for the safe storage and controlled release of ballast. The ballast must consist of material that, if released during flight, is not hazardous to persons on the ground.

531.53 *Drag Rope*

If a drag rope is used, the end that is released overboard must be stiffened to preclude the probability of the rope becoming entangled with trees, wires, or other objects on the ground.

531.55 *Deflation Means*

There must be a means to allow emergency deflation of the envelope so as to allow a safe emergency landing. If a system other than a manual system is used, the reliability of the system used must be substantiated.

531.57 *Rip Cords*

(a) If a rip cord is used for emergency deflation, it must be designed and installed to preclude entanglement.

(b) The force required to operate the rip cord may not be less than 25 or more than 75 lbs (111N and 334 N).

(c) The end of the rip cord to be operated by the pilot must be coloured red.

(d) The rip cord must be long enough to allow an increase of at least 10% in the vertical dimension of the envelope.

531.59 *Trapeze, Basket or Other Means Provided for Occupants*

(a) The trapeze, basket, or other means provided for carrying occupants may not rotate independently of the envelope.

(b) Each projecting object on the trapeze, basket, or other means provided for carrying occupants, that could cause injury to the occupants, must be padded.

531.61 *Static Discharge*

Unless shown not to be necessary for safety, there must be appropriate bonding means in the design of each balloon using flammable gas as a lifting means to ensure that the effects of static discharges will not create a hazard.

531.63 *Safety Belts*

(a) There must be a safety belt, harness, or other restraining means for each occupant, unless the Minister finds it unnecessary. If installed, the belt, harness, or other restraining means and its supporting structure must meet the strength requirements of Sub-chapter C.

(b) This section does not apply to balloons that incorporate a basket or gondola.

531.65 *Position Lights*

(a) If position lights are installed, there must be one steady aviation white position light and one flashing aviation red (or flashing aviation white) position light with an effective flash frequency of at least 40, but not more than 100, cycles per minute.

(b) Each light must have 360° horizontal coverage at the intensities prescribed in this paragraph. The following light intensities must be determined with the light source operating at a steady state and with all light covers and colour filters in place and at the manufacturer's rated minimum voltage. For the flashing aviation red light, the measured values must be adjusted to correspond to a red filter temperature of at least 130° F (54.44°C):

(1) The intensities in the horizontal plane passing through the light unit must equal or exceed the following values:

Position Light	Minimum intensity (candles)
Steady White	20
Flashing Red or White	40

Table i

(2) The intensities in vertical planes must equal or exceed the following values. An intensity of one unit corresponds to the applicable horizontal plane intensity specified in paragraph (b)(1) of this section.

Angles above and below the horizontal in any vertical plane (degrees)	**Minimum intensity (units)**
0......................	1.00
0 to 5	0.90
5 to 10	0.80
10 to 15	0.70
15 to 20	0.50
20 to 30	0.30
30 to 40	0.10
40 to 60	0.05

Table ii

(c) The steady white light must be located not more than 20 ft (6.1 m) below the basket, trapeze, or other means for carrying occupants. The flashing red or white light must be located not less than 7 (2.1 m), nor more than 10 ft (3.05 m), feet below the steady white light.

(d) There must be a means to retract and store the lights.

(e) Each position light colour must have the applicable International Commission on Illumination chromaticity co-ordinates as follows:

(1) Aviation red:

"y" is not greater than 0.335; and "z" is not greater than 0.002.

(2) Aviation white:

"x" is not less than 0.300 and not greater than 0.540;

"y" is not less than "x - 0.040" or

"y_o - 0.010", whichever is the smaller; and

"y" is not greater than "x + 0.020" nor "0.636 - 0.400x";

Where "y_o" is the "y" co-ordinate of the Planckian radiator for the value of "x" considered.

SUBCHAPTER E
EQUIPMENT

531.71 *Function and Installation*

(a) Each item of installed equipment must:

(1) Be of a kind and design appropriate to its intended function;

(2) Be permanently and legibly marked or, if the item is too small to mark, tagged as to its identification, function, or operating limitations, or any applicable combination of those factors;

(3) Be installed according to limitations specified for that equipment; and

(4) Function properly when installed.

(b) No item of installed equipment, when performing its function, may affect the function of any other equipment so as to create an unsafe condition.

(c) The equipment, systems, and installations must be designed to prevent hazards to the balloon in the event of a probable malfunction or failure.

SUBCHAPTER F
OPERATING LIMITATIONS AND INFORMATION

531.81 *General*

(a) The following information must be established:

(1) Each operating limitation, including the maximum weight determined under 531.14.

(2) The normal and emergency procedures.

(3) Other information necessary for safe operation, including:

(i) The empty weight determined under 531.16;

(ii) The rate of climb determined under 531.17, and the procedures and conditions used to determine performance;

(iii) The maximum vertical velocity, the altitude drop required to attain that velocity, and altitude drop required to recover from a descent at that velocity, determined under 531.19, and the procedures and conditions used to determine performance; and

(iv) Pertinent information peculiar to the balloon's operating characteristics.

(b) The information established in compliance with paragraph (a) of this section must be furnished by means of:

(1) A Balloon Flight Manual.

(2) Deleted.

(c) Units.

(1) The Flight Manual shall include Système International (SI), and Imperial units until such time as SI units are the only national units, with the exception that:

(i) airspeed, altitude, vertical speed and altimeter setting shall remain in knots, feet, feet per minute and inches of mercury, respectively;

(ii) Imperial Volumes (e.g. Imperial Gallons) need not be included:

(2) The systems of units used must be properly identified, cross referenced, and presented to prevent misunderstanding; and

(3) Aircraft instrument readings shall be presented in the Flight Manual in the units used on the instruments.

(d) Operating rules. In the Flight Manual there shall be no reference to specific operating rules.

FAR: No relative information.

531.82 *Instructions for Continued Airworthiness*

The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix A to this chapter that are acceptable to the Minister. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first balloon or issuance of a standard certificate of airworthiness, whichever occurs later.

531.83 *Conspicuity*

The exterior surface of the envelope must be of a contrasting colour or colours so that it will be conspicuous during operation. However, multicoloured banners or streamers are acceptable if it can be shown that they are large enough, and there are enough of them of contrasting colour, to make the balloon conspicuous during flight.

531.85 *Required Basic Equipment*

In addition to any equipment required by this manual for a specific kind of operation, the following equipment is required:

(a) For all balloons:

(1) (Reserved).

(2) An altimeter.

(3) A rate of climb indicator.

(b) For hot air balloons:

(1) A fuel quantity gauge. If fuel cells are used, means must be incorporated to indicate to the crew the quantity of fuel in each cell during flight. The means must be calibrated in appropriate units or in percent of fuel cell capacity.

(2) An envelope temperature indicator.

(c) For captive gas balloons: a compass.

APPENDIX A
INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

A531.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by 531.82.

(b) The Instructions for Continued Airworthiness for each balloon must include the Instructions for Continued Airworthiness for all balloon parts required by any applicable airworthiness or operational rule and any required information relating to the interface of those parts with the balloon. If Instructions for Continued Airworthiness are not supplied by the part manufacturer for a balloon part, the Instructions for Continued Airworthiness for the balloon must include the information essential to the continued airworthiness of the balloon.

(c) The applicant must submit to the Minister a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of balloon parts will be distributed.

A531.2 Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

A531.3 Content

The Instructions for Continued Airworthiness must contain the following information:

(a) Introduction information that includes an explanation of the balloon's features and data to the extent necessary for maintenance or preventive maintenance.

(b) A description of the balloon and its systems and installations.

(c) Basic control and operation information for the balloon and its components and systems.

(d) Servicing information that covers details regarding servicing of balloon components, including burner nozzles, fuel tanks, and valves during operations.

(e) Maintenance information for each part of the balloon and its envelope, controls, rigging, basket structure, fuel systems, instruments, and heater assembly that provides the recommended periods at which they should be cleaned, adjusted, tested, and lubricated, the applicable wear tolerances, and the degree of work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally

high degree of complexity requiring specialised maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the balloon.

(f) Troubleshooting information describing probable malfunctions, how to recognise those malfunctions, and the remedial action for those malfunctions.

(g) Details of what, and how, to inspect after a after a Harding Landing.

(h) Instructions for storage preparation, including any storage limits.

(i) Instructions for repair of the balloon envelope and its basket or trapeze.

A531.4 Airworthiness Limitations Section

[The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure, including envelope structural integrity, required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads:

"The Airworthiness Limitations section is approved by the Minister and specifies maintenance requirements that are mandatory for the continued airworthiness of this aircraft as specified in CAR 605.84".]

(Change 531-1 (91-06-01))

(Change 531-2 (97-04-07))

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 533 - AIRCRAFT ENGINES

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa (Ontario)
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51-15/533-2010E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2010-1 (2010/[illegible])	[illegible]	[illegible]
2010-2 (2010/05/[illegible])	[illegible]	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL
CHAPTER 533 - AIRCRAFT ENGINES

<u>Table of Contents</u>

Interpretation Provision for Part V Standards

In these Standards:

(a) The passages giving the Minister power to determine, approve, establish or authorise something without stating criteria for the use of such power are to be interpreted as requiring that the power be used in consideration of two factors only: the airworthiness of the aircraft that is the subject of the determination, approval or authorisation, or on which an aeronautical product that is the subject of the determination, approval or authorisation is to be installed, and the aircraft's level of safety;

(b) the word "approved" or "authorised", when used without an indication of a method of approval or authorisation, is to be interpreted as referring to an approval or an authorisation granted under the Aeronautics Act.

Preamble

General

The content of this chapter is based on the United States Code of Federal Regulations, Title 14, Chapter I, Part 33 entitled Airworthiness Standards, Aircraft Engines. These United States airworthiness standards have been used and adapted as the model for the Canadian standards supplemented by additional airworthiness requirements based on Canadian experience and required for Canadian aviation purposes.

The FAR numbering system is used. The Canadian standards bear the same number as the FAR equivalent, prefixed by the number "5", as this chapter contains the standards for Part V of the *Canadian Aviation Regulations* (CARs).

* * * * * *

First Edition **Effective: January 1, 1986**

The first edition of this chapter is based on FAR Part 33, up to and including amendment 33-10 published in the Federal Register dated February 23, 1984. Except for administrative changes (e.g., Administrator = Minister; Part = Chapter) and the deletion of references to operating FARs, there are no Canadian variations included in this first edition.

The standards in this chapter are presented in a two column format with the United States FAR in the left column and the Canadian standards in the right column. Chapters, sub-chapters, sections and subsections numbering and headings are opposite to the equivalent FAR. Where the Canadian standard is identical to the FAR, the words "No Variation" appear; where a variation exists, the affected part of text is printed opposite to the FAR with all changes underlined.

AMA 533.90 entitled "Initial Maintenance Inspection" dated Jan. 1, 1987 is attached to this chapter.

* * * * * *

Change 533-1 **Effective: January 1, 1987**

This change incorporates Amendment 33-11 to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33 published in the Federal Register dated March 25, 1986.

- Amendment 33-11, "Turboprop Engine Propeller Brake", establishes a new standards applicable to turbopropeller engines equipped with a propeller brake. This amendment is needed to establish an appropriate level of safety for certification of aircraft engines with this feature.

Note:

In 533-1 changes were identified by marginal black lines. In the future, changes will be identified by " " brackets. Editorial alterations and typographical corrections will not be identified.

* * * * * *

Change 533-2 **Effective: January 1, 1989**

This change incorporates amendment 33-12 to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33 published in the Federal Register on September 2, 1988. This amendment introduces the term "One-engine-inoperative (OEI)" rating, and its application, as used in "rated continuous OEI power", "rated 30-minute OEI power", and "rated 2 1/2 minute OEI power", together with additional requirements to be met in the endurance testing of rotorcraft engines.

* * * * * *

Change 533-3 **Effective: 1 November 1991**

This change introduces an amendment to section 533.1 paragraph (b) to refer to:

- the Air Regulation enabling the type approval of aeronautical products and Chapter 511; and

- Chapter 516, Second Edition; subchapter B.

In addition, the following amendments to the United States Code of Federal Regulations, Title 14, Chapter 1, Part 33 are included in the FAR text (left column) for completeness:

- Amendment 33-13, published in the Federal Register dated August 18, 1989, is part of a larger reorganisation of the general U.S. operating and flight rules. This amendment changes a cross reference to Part 91 in Appendix A of Part 31; therefore, it does not affect Canadian standards.

- Amendment 33-14 "Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Aircraft", published in the Federal Register dated August 10, 1990. This amendment introduces the requirement that new turbine engines shall comply with the requirements of the new FAR Part 34. Part 34 recodifies the aircraft engine fuel venting and exhaust emission standards of Special Federal Aviation Regulation (SFAR) 27-5. Transport Canada has adopted the fuel venting and engine emission standards of ICAO, Annex 16, Volume II entitled "Aircraft Engine Emission", First Edition - 1981. Accordingly, section 533.1 is amended to refer to Chapter 516, Second Edition, Subchapter B.

* * * * * *

Change 533-4 **Effective: 30 December 1993**

This change incorporates amendment 33-15 to the United States Code of Federal Regulations, Title 14 Chapter I, Part 33 in the Federal Register on May 18, 1993. This amendment establishes requirements for the approval of electric and electronic engine control (EEC) systems as presented in this FAA Final Rule. Although these types of control systems have been approved under existing regulations, they do not address specific requirements related to EEC.

* * * * * *

Second Edition

Change 533-5 Published with Amendment 1999-4 of the CARs on 1 December 1999

This second edition introduces a new full page format and does not feature the left-hand column containing the FARs. Only the Canadian variations from the FARs are underlined with the FAR text following in a shaded box. The amendment number and date of affected *pages* has been removed from the bottom of the page. Instead, affected *sections* will be followed by amendment numbers and dates of current changes as well as any previous changes.

This change incorporates the following amendments to the United States Code of Federal Regulations, Title 14, Chapter 1, Part 33:

Information Note:

Amendment 33-16, which is for the revision of the U.S. authority citation, is not applicable in Canada and is not adopted.

Amendment 33-17 **Effective 7 April 1997**

- This amendment entitled: "Continued Rotation and Rotor Locking Tests, and Vibration and Vibration Tests" published in the Federal Register dated June 4, 1996 revises the continued rotation and vibration certification standards for aircraft engines. This amendment is the result of an effort to harmonize the Federal Aviation Regulations with European Joint Airworthiness Authorities requirements. Furthermore, the increased uniformity of airworthiness requirements among the respective countries will simplify international airworthiness approval. Transport Canada shares this objective of International harmonization of airworthiness standards for the certification of aircraft engines. The adoption of this amendment has been subjected to consultation with Canadian aviation industry through NPA 96-07.

Amendment 33-18 **Effective 7 April 1997**

- This amendment entitled: "Aircraft Engines New One-Engine-Inoperative (OEI) Ratings, Definitions and Type Certification Standards" published in the Federal Register dated June 19, 1996 establishes definitions and type certification of standards for new rotorcraft 30-second and 2-minute one-engine-inoperative (OEI) ratings. These new OEI ratings at higher power levels will enhance rotorcraft safety after an engine failure or precautionary shutdown. In addition, this amendment improves rotorcraft take-off and landing performances and allows for the installation of higher rated engines by rotorcraft manufacturers which will enable higher payload or shorter field take-off. The adoption of this amendment has been subjected to consultation with Canadian aviation industry through NPA 96-07.

Amendment 33-19 **Effective 29 October 1998**

- This amendment entitled: "Airworthiness Standards; Rain and Hail Ingestion Standards" published in the Federal Register dated March 26, 1998 establish revisions to the Federal Aviation Administration's certification standards for rain and hail ingestion for aircraft turbine engines. These amendments address engine power-loss and instability phenomena attributed to operation in extreme rain or hail that are not adequately addressed by current requirements. These amendments also generally harmonise these standards with rain and hail ingestion standards being amended by the Joint Aviation Authorities (JAA). These amendments establish nearly uniform standards for engines certified in the United States under 14 CFR Part 33 and in the JAA countries under Joint Airworthiness Requirements-Engines (JAR-E), thereby simplifying the certification of engine designs by the FAA and the JAA. Transport Canada shares this objective of International harmonisation of airworthiness standards for the certification of aircraft engines. The adoption of this amendment has been subjected to consultation with Canadian aviation industry through NPA 98-159.

* * * * * *

Change 533-6 **Published: December 1, 2003**

1. **General**

This change introduces a new amendment format. This new amendment format is introduced in Chapter 533 of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following changes to the amendment procedures are introduced in this Change 533-6:

- the preamble will be the focal point regarding the sections affected by this change. The change number will no longer be provided at the end of an amended section. Rather, for the current change only, an amendment tag identifying the coming into force date of the provision will follow the amended text. (example: (amended 2003/06/01))

- brackets “ ” will no longer be used to identify new or revised text. In the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted but followed by an electronic link to the previous version of the modified text. (example: (amended 2003/06/01; previous version))
- the preamble will include a table of change information. This table will include the Notices of Proposed Amendments (NPAs) with the corresponding amended sections.

2. **FAR Amendments**

This change incorporates the following amendments to the *United States Code of Federal Regulations*, Title 14, Chapter I, Part 33:

FAR Amendment 33-20 **Effective: March 5, 2001**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2000-265	533.76
	533.77

This amendment revises the bird ingestion type certification standards for aircraft turbine engines to better address the actual bird threat encountered in service. This amendment also establishes nearly uniform bird ingestion standards for aircraft turbine engines certified by the United States under FAA standards and by the Joint Aviation Authorities (JAA) countries under JAA standards, thereby simplifying airworthiness approval for import and export.

3. **CARAC Proposed Amendment Recommendations**

There are no proposed changes to the standard recommended by the CARAC Technical Committee Part V - Certification.

Change 533-7 **Effective: December 1, 2004**

In an effort to harmonize our regulatory guidance documents with those of other international aviation authorities and other branches within Transport Canada Civil Aviation (TCCA), the Aircraft Certification Branch has decided to replace existing Airworthiness Manual Advisories (AMA) related to certification of aeronautical products with new Advisory Circulars (AC). While the content of the new ACs will remain technically the same as the corresponding AMAs, which they will replace, the format of the ACs will be standardized to conform to other guidance documents published within the branch.

This change in guidance documentation becomes effective 1 December 2004 at which time the AMAs will be cancelled and replaced by their corresponding Advisory Circular concurrent with the next publishing of the Canadian Aviation Regulations (CAR). After this time, the CARAC Secretariat will no longer publish these AMAs and, consequently, ACs will not be published with their corresponding AWM Chapter. As of the 1 December 2004 issue of the CARs, any affected AMA references and content will have been removed. However, the AMA Index found in AMA 500/00 will, for now, continue to exist to provide a cross-reference between the old AMAs and the new ACs.

Change 533-8 **Published December 30, 2006**

Correction to English version **Effective: December 11, 2003**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2003-257	533.7

This amendment entitled "Engine Ratings & Operating Limitations" corrects the English version of Section 533.7 of Chapter 533 of the Airworthiness Manual (AWM), which is currently missing subparagraph (c)(5)(v) as compared to the French version of the same section. There was no intention to create a Canadian variation as compared to the equivalent Federal Aviation Regulations Part 33, section 33.7 by omitting the missing subparagraph. Hence, the missing subparagraph is added to Chapter 533 of the AWM in order to remain harmonized with the subject section of FAR Part 33.

This change also incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33:

Correction to FAR Amendment 33-20 **Effective: June 8, 2004**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2004-029	533.76

This amendment entitled "Bird Ingestion" adopts by reference FAA correction to FAR Amendment No. 33-20. FAR Amdt. No. 33-20 had originally been adopted with NPA 2000-265 and published at Change 533-6 of Airworthiness Manual Chapter 533.

As published, the adopted standards contain errors that may prove to be misleading and need to be clarified. Corrections are provided for paragraphs (c)(5), (c)(7)(ii), (c)(7)(vii), (c)(7)(viii), (c)(7)(ix), (c)(8)(v), (c)(8)(vi), Table 1 and Table 2 of section 533.76.

Change 533-9 **Published December 30, 2008**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33:

FAR Amendment 33-22 **Effective: October 30, 2008**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2007-035	533.14 533.34 533.70

This amendment entitled "Aircraft Engine Standards for Engine Life-Limited Parts" establishes new and uniform standards for the design and testing of life-limited parts for aircraft engines. It retains the current lifing requirements and introduces damage tolerance requirements. In addition, new standards for the design of reciprocating engine turbocharger rotors are being added.

FAR Amendment 33-23 **Effective: October 30, 2008**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2007-034	533.76

This amendment entitled "Engine Bird Ingestion" amends the aircraft turbine engine type certification standards to better address the threat that flocking birds present to turbine engine aircraft.

FAR Amendment 33-24 **Effective: October 30, 2008**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2007-036	533.5 533.74 533.75 533.76

This amendment entitled "Safety Analysis" amends the safety analysis type certification standard for turbine aircraft engines.

Change 533-10 **Published: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the Canadian Aviation Regulations (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends section 533.1 to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

Change 533-11 **Published: June 1, 2010**

This Change incorporates the following amendments to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33:

FAR Amendment 33-26 **Effective: January 29, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-008	• 533.5 • 533.7 • 533.27 • 533.28 • 533.29 • 533.53 • 533.67 • 533.88 • 533.91

This amendment entitled “Engine Control System Requirements” amends the airworthiness standards for aircraft engine control systems. These changes reflect current industry practices and harmonize TCCA standards with those of the Federal Aviation Administration (FAA) and with those recently adopted by the European Aviation Safety Agency (EASA).

FAR Amendment 33-27 **Effective: January 29, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-009	• 533.64 • 533.71 • 533.91

This amendment entitled "Aircraft Engine Standards for Pressurized Engine Static Parts" amends the airworthiness standards for aircraft engines by adding and making changes to standards for pressurized engine static parts. These standards, harmonized with the FAA, are equivalent to those already adopted by the EASA.

FAR Amendment 33-25 **Effective: January 29, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-011	• 533.5 • 533.29 • 533.67 • 533.87 • 533.88 • 533.93 • Appendix A

This amendment entitled "Rotorcraft Turbine Engines One-Engine-Inoperative (OEI) Ratings, Type Certification Standards" revises the airworthiness standards by revising the ratings' standards to reflect recent analyses of the ratings' use and lessons learned from completed engine certifications and service experience. This amendment harmonizes type certification standards for these ratings with the FAA and EASA.

FAR Amendment 33-28 **Effective: January 29, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-014	• 533.19

This amendment entitled "Airworthiness Standards; Propellers" amends the airworthiness standards for aeroplane propellers. The previous propeller requirements did not adequately address the technological advances of the past twenty years. The new standards address these advances in technology and harmonize Transport Canada Civil Aviation (TCCA), FAA, and EASA propeller certification requirements, thereby simplifying airworthiness approvals for imports and exports.

Change 533-12 **Published: December 1, 2010**

This change incorporates the following amendment to the United States Code of Federal Regulations, Title 14, Chapter I, Part 33:

FAR Amendment 33-29 **Effective: May 27, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-121	533.17

This amendment entitled "Fire Protection" amends the airworthiness standards for aircraft engines with respect to minimizing the probability and effect of a fire in and/or around the engine. This amendment harmonizes paragraph 533.17 of the Airworthiness Manual with the FAR part 33 and EASA CS-E standards.

FAR Amendment 33-30 **Effective: May 27, 2010**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
2009-119	533.7 533.84 533.87

This amendment entitled “Aircraft Engine Standards Overtorque Limits” establishes new engine overtorque testing requirements, amends engine ratings and operating limits and defines maximum overtorque for certain turbopropeller and turboshaft engines.

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL
CHAPTER 533 - AIRCRAFT ENGINES

SUBCHAPTER A
GENERAL

533.1 *Applicability*

(a) This Chapter sets out airworthiness standards for the issue of type certificates and changes to type certificates, for aircraft engines.
(amended 2009/12/01)

(b) Reserved.
(amended 2009/12/01)

(Change 533-3 (91-11-01))

(Change 533-5)

533.3 *General*

Each applicant must show that the aircraft engine concerned meets the applicable requirements of this chapter.

533.4 *Instructions for Continued Airworthiness*

The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix A to this Chapter that are acceptable to the Minister. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first aircraft with the engine installed, or upon issuance of a standard certificate of airworthiness for the aircraft with the engine installed, whichever occurs later.

533.5 *Instruction Manual for Installing and Operating the Engine*

Each applicant shall prepare and make available to the Minister prior to the issuance of the type approval, and to the owner at the time of delivery of the engine, approved instructions for installing and operating the engine. The instructions shall include at least the following:
(amended 2008/10/30)

(a) Installation instructions

(1) The location of engine mounting attachments, the method of attaching the engine to the aircraft, and the maximum allowable load for the mounting attachments and related structure.

(2) The location and description of engine connections to be attached to accessories, pipes, wires, cables, ducts and cowling.

(3) An outline drawing of the engine including overall dimensions.

(4) A definition of the physical and functional interfaces with the aircraft and aircraft equipment, including the propeller when applicable.
(amended 2010/01/29)

(5) Where an engine system relies on components that are not part of the engine type design, the interface conditions and reliability requirements for those components upon which engine type certification is based must be specified in the engine installation instructions directly or by reference to appropriate documentation.
(amended 2010/01/29)

(6) A list of the instruments necessary for control of the engine, including the overall limits of accuracy and transient response required of such instruments for control of the operation of the engine must also be stated so that the suitability of the instruments as installed may be assessed.
(amended 2010/01/29)

(b) Operating instructions

(1) The operating limitations established by the Minister.

(2) The power or thrust ratings and procedures for correcting for non-standard atmosphere.

(3) The recommended procedures, under normal and extreme ambient conditions for:

(i) Starting;

(ii) Operating on the ground; and

(iii) Operating during flight.

(4) For rotorcraft engines having one or more OEI ratings, applicants must provide data on engine performance characteristics and variability to enable the aircraft manufacturer to establish aircraft power assurance procedures.
(amended 2010/01/29)

(5) A description of the primary and all alternate modes and any back-up system, together with any associated limitations, of the engine control system and its interface

with the aircraft systems, including the propeller when applicable.
(amended 2010/01/29)

(c) Safety analysis assumptions
(amended 2008/10/30)

The assumptions of the safety analysis as described in 533.75(d) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.
(amended 2008/10/30)

533.7 *Engine Ratings & Operating Limitations*

(a) Engine ratings and operating limitations are established by the Minister and included in the engine type Certification data sheet, including ratings and limitations based on the operating conditions and information specified in this section, as applicable, and any other information found necessary for safe operation of the engine.

(b) For reciprocating engines, ratings and operating limitations are established relating to the following:

(1) Horsepower or torque, r.p.m., manifold pressure, and time at critical pressure altitude and sea level pressure altitude for:

(i) Rated maximum continuous power (relating to unsupercharged operation or to operation in each supercharger mode as applicable); and

(ii) Rated take-off power (relating to unsupercharged operation or to operation in each supercharger mode as applicable).

(2) Fuel grade or specification.

(3) Oil grade or specification.

(4) Temperature of the:

(i) Cylinder;

(ii) Oil at the oil inlet; and

(iii) Turbo-supercharger turbine wheel inlet gas.

(5) Pressure of:

(i) Fuel at the fuel inlet; and

(ii) Oil at the main oil gallery.

(6) Accessory drive torque and overhang moment.

(7) Component life.

(8) Turbosupercharger turbine wheel r.p.m.

(c) For turbine engines, ratings and operating limitations are established relating to the following:

(1) Horsepower, torque, or thrust, r.p.m., gas temperature, and time for:

(i) Rated maximum continuous power or thrust (augmented);

(ii) Rated maximum continuous power or thrust (unaugmented);

(iii) Rated take-off power or thrust (augmented);

(iv) Rated take-off power or thrust (unaugmented);

(v) Rated 30 minute OEI power;

(vi) Rated 2 1/2 minute OEI power;

(vii) Rated continuous OEI power;

(viii) Rated 2-minute OEI power;

(ix) Rated 30-second OEI power; and

(x) Auxiliary power unit (APU) mode of operation.

(2) Fuel designation or specification.

(3) Oil grade or specification.

(4) Hydraulic fluid specification.

(5) Temperature of:

(i) Oil at a location specified by the applicant;

(ii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient over-temperature and time allowed;

(iii) Hydraulic fluid of a supersonic engine;

(iv) Fuel at a location specified by the applicant; and

(v) External surfaces of the engine, if specified by the applicant.
(amended 2003/12/11)

(6) Pressure of:

(i) Fuel at the fuel inlet;

(ii) Oil at a location specified by the applicant;

(iii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient overpressure and time allowed; and

(iv) Hydraulic fluid.

(7) Accessory drive torque and overhang movement.

(8) Component life.

(9) Fuel filtration.

(10) Oil filtration.

(11) Bleed air.

(12) The number of start-stop stress cycles approved for each rotor disc and spacer.

(13) Inlet air distortion at the engine inlet.

(14) Transient rotor shaft overspeed r.p.m. and number of overspeed occurrences.

(15) Transient gas overtemperature and number of overtemperature occurrences.

(16) Transient engine overtorque and number of overtorque occurrences.
(amended 2010/05/27)

(17) Maximum engine overtorque for turbopropeller and turboshaft engines incorporating free power turbines.
(amended 2010/05/27)

(*d*) In determining the engine performance and operating limitations, the overall limits of accuracy of the engine control system and of the necessary instrumentation as defined in 533.5(a)(6) must be taken into account.
(amended 2010/01/29)

(Change. 533-1 (87-01-01))

(Change 533-2 (89-01-01))

(Change 533-5)

533.8 *Selection of Engine Power and Thrust Ratings*

(a) Requested engine power and thrust ratings must be selected by the applicant.

(b) Each selected rating must be for the lowest power or thrust that all engines of the same type may be expected to produce under the conditions used to determine that rating.

SUBCHAPTER B
DESIGN & CONSTRUCTION: GENERAL

533.11 *Applicability*

This subchapter prescribes the general design and construction requirements for reciprocating and turbine aircraft engines.

533.13 *(Reserved)*

533.14 *(Removed)*
(amended 2008/10/30)

533.15 *Materials*

The suitability and durability of materials used in the engine must:

(a) Be established on the basis of experience or tests; and

(b) Conform to approved specifications (such as industry or military specifications) that ensure their having the strength and other properties assumed in the design data.

533.17 *Fire Protection*
(amended 2010/05/27)

(a) The design and construction of the engine and the materials used must minimise the probability of the occurrence and spread of fire during normal operation and failure conditions, and must minimise the effect of such a fire. In addition, the design and construction of turbine engines must minimise the probability of the occurrence of an internal fire that could result in structural failure or other hazardous conditions.
(amended 2010/05/27)

(b) Except as provided in paragraph (c) of this section, each external line, fitting and other component, which contains or conveys flammable fluid during normal engine operation, must be fire resistant or fireproof, as determined by the Minister. Components must be shielded or located to safeguard against the ignition of leaking flammable fluid.
(amended 2010/05/27)

(c) A tank, which contains flammable fluid and any associated shut-off means and supports, which are part of and attached to the engine must be fireproof either by construction or by protection unless damage by fire will not cause leakage or spillage of a hazardous quantity of flammable fluid. For a reciprocating engine having an integral oil sump of less than 23.7 litres (25-quart) capacity, the oil sump need not be fireproof or enclosed by a fireproof shield.
(amended 2010/05/27)

(d) An engine component designed, constructed and installed to act as a firewall must be:
(amended 2010/05/27)

(1) Fireproof;

(2) Constructed so that no hazardous quantity of air, fluid or flame can pass around or through the firewall; and

(3) Protected against corrosion;

(e) In addition to the requirements of paragraphs (a) and (b) of this section, engine control system components that are located in a designated fire zone must be fire resistant or fireproof, as determined by the Minister.
(amended 2010/05/27)

(f) Unintentional accumulation of hazardous quantities of flammable fluid within the engine must be prevented by draining and venting.
(amended 2010/05/27)

(g) Any components, modules, or equipment, which are susceptible to, or are potential sources of static discharges or electrical fault currents must be designed and constructed to be properly grounded to the engine reference, to minimise the risk of ignition in external areas where flammable fluids or vapours could be present.
(amended 2010/05/27)

533.19 *Durability*

(a) Engine design and construction must minimise the development of an unsafe condition of the engine between overhaul periods. The design of the compressor and turbine rotor cases must provide for the containment of damage from rotor blade failure. Energy levels and trajectories of fragments resulting from rotor blade failure that lie outside the compressor and turbine rotor cases must be defined.

(b) Each component of the propeller blade pitch control system which is a part of the engine type design must meet the requirements of sections 535.21, 535.23, 535.42 and 535.43 of this Manual.
(amended 2010/01/29)

533.21 *Engine Cooling*

Engine design and construction must provide the necessary cooling under conditions in which the aeroplane is expected to operate.

533.23 *Engine Mounting Attachments and Structure*

(a) The maximum allowable limit and ultimate loads for engine mounting attachments and related structure must be specified.

(b) The engine mounting attachments and related engine structure must be able to withstand:

(1) The specified limit loads without permanent deformation; and

(2) The specified ultimate loads without failure, but may exhibit permanent deformation.

533.25 *Accessory Attachments*

The engine must operate properly with the accessory drive and mounting attachments loaded. Each engine accessory drive and mounting attachment must include provisions for sealing to prevent contamination of, or unacceptable leakage from, the engine interior. A drive and mounting attachment requiring lubrication for external drive splines, or coupling by engine oil, must include provisions for sealing to prevent unacceptable loss of oil and to prevent contamination from sources outside the chamber enclosing the drive connection. The design of the engine must allow for the examination, adjustment, or removal of each accessory required for engine operation.

533.27 *Turbine, Compressor, Fan & Turbosupercharger Rotors*

(a) Turbine, compressor, fan, and turbosupercharger rotors must have sufficient strength to withstand the test conditions specified in paragraph (c) of this section.

(b) The design and functioning of engine systems, instruments and other methods, not covered under 533.28 must give reasonable assurance that those engine operating limitations that affect turbine, compressor fan and turbosupercharger rotor structural integrity will not be exceeded in service.
(amended 2010/01/29)

(c) The most critically stressed rotor component (except blades) of each turbine, compressor, and fan, including integral drum rotors and centrifugal compressors in an engine or turbosupercharger, as determined by analysis or other acceptable means, must be tested for a period of 5 minutes:

(1) At its maximum operating temperature, except as provided in paragraph (c)(2)(iv) of this section; and

(2) At the highest speed of the following, as applicable:

(i) 120 percent of its maximum permissible r.p.m. if tested on a rig and equipped with blades or blade weights;

(ii) 115 percent of its maximum permissible r.p.m. if tested on an engine;

(iii) 115 percent of its maximum permissible r.p.m. if tested on turbosupercharger driven by a hot gas supply from a special burner rig.

(iv) 120 percent of the r.p.m. at which, while cold spinning, it is subject to operating stresses that are equivalent to those induced at the maximum operating temperature and maximum permissible r.p.m.

(v) 105 percent of the highest speed that would result from failure of the most critical component or system in a representative installation of the engine.

(vi) The highest speed that would result from the failure of any component or system in a representative installation of the engine, in combination with any failure of a component or system that would not normally be detected during a routine pre-flight check or during normal flight operation.

Following the test, each rotor must be within approved dimensional limits for an overspeed condition and may not be cracked.

533.28 *Electrical and Electronic Engine Control Systems*

Each control system which relies on electrical and electronic means for normal operation must:

(a) Applicability. These requirements are applicable to any system or device that is part of engine type design that controls, limits or monitors engine operation and is necessary for the continued airworthiness of the engine.
(amended 2010/01/29)

(b) Validation.
(amended 2010/01/29)

(1) Functional aspects. The applicant must substantiate by tests, analysis or a combination thereof, that the engine control system performs the intended functions in a manner which: (amended 2010/01/29)

(i) Enables selected values of relevant control parameters to be maintained and the engine kept within the approved operating limits over changing atmospheric conditions in the declared flight envelope;
(amended 2010/01/29)

(ii) Complies with the operability requirements of 533.51, 533.65 and 533.73, as appropriate, under all likely system inputs and allowable engine power or thrust demands, unless it can be demonstrated that failure of the control function results in a non-dispatchable condition in the intended application;
(amended 2010/01/29)

(iii) Allows modulation of engine power or thrust with adequate sensitivity over the declared range of engine operating conditions; and
(amended 2010/01/29)

(iv) Does not create unacceptable power or thrust oscillations.
(amended 2010/01/29)

(2) Environmental limits. The applicant must demonstrate, when complying with 533.53 or 533.91, that the engine control system functionality will not be adversely affected by declared environmental conditions, including electromagnetic interference (EMI), High Intensity Radiated Fields (HIRF) and lightning. The limits to which the system has been qualified must be documented in the engine installation instructions.
(amended 2010/01/29)

(c) Control transitions.
(amended 2010/01/29)

(1) The applicant must demonstrate that, when fault or failure results in a change from one control mode to another, from one channel to another, or from the primary system to the back-up system, the change occurs so that:
(amended 2010/01/29)

(i) The engine does not exceed any of its operating limitations;
(amended 2010/01/29)

(ii) The engine does not surge, stall or experience unacceptable thrust or power changes or oscillations or other unacceptable characteristics; and
(amended 2010/01/29)

(iii) There is a means to alert the flight crew if the crew is required to initiate, respond to or be aware of the control mode change. The means to alert the crew must be described in the engine installation instructions and the crew action must be described in the

engine operating instructions;
(amended 2010/01/29)

(2) The magnitude of any change in thrust or power and the associated transition time must be identified and described in the engine installation instructions and the engine operating instructions.
(amended 2010/01/29)

(d) Engine control system failures. The applicant must design and construct the engine control system so that:
(amended 2010/01/29)

(1) The rate for Loss of Thrust (or Power) Control (LOTC/LOPC) events, consistent with the safety objective associated with the intended application can be achieved;
(amended 2010/01/29)

(2) In the full-up configuration, the system is single fault tolerant, as determined by the Minister, for electrical or electronic failures with respect to LOTC/LOPC events;
(amended 2010/01/29)

(3) Single failures of engine control system components do not result in a hazardous engine effect; and
(amended 2010/01/29)

(4) Foreseeable failures or malfunctions leading to local events in the intended aircraft installation, such as fire, overheat or failures leading to damage to engine control system components, do not result in a hazardous engine effect due to engine control system failures or malfunctions.
(amended 2010/01/29)

(e) System safety assessment. When complying with this section and 533.75, the applicant must complete a System Safety Assessment for the engine control system. This assessment must identify faults or failures that result in a change in thrust or power, transmission of erroneous data, or an effect on engine operability producing a surge or stall together with the predicted frequency of occurrence of these faults or failures.
(amended 2010/01/29)

(f) Protection systems
(amended 2010/01/29)

(1) The design and functioning of engine control devices and systems, together with engine instruments and operating and maintenance instructions, must provide reasonable assurance that those engine operating limitations that affect turbine, compressor, fan, and turbosupercharger rotor structural integrity will not be exceeded in service.
(amended 2010/01/29)

(2) When electronic overspeed protection systems are provided, the design must include a means for testing, at least once per engine start/stop cycle, to establish the availability of the protection function. The means must be such that a complete test of the system can be achieved in the minimum number of cycles. If the test is not fully automatic, the requirement for a manual test must be contained in the engine instructions for operation.
(amended 2010/01/29)

(3) When overspeed protection is provided through hydromechanical or mechanical means, the applicant must demonstrate by test or other acceptable means that the overspeed function remains available between inspection and maintenance periods.
(amended 2010/01/29)

(g) Software. The applicant must design, implement and verify all associated software to minimize the existence of errors by using a method, approved by the Minister, consistent with the criticality of the performed functions.
(amended 2010/01/29)

(h) Aircraft-supplied data. Single failures leading to loss, interruption or corruption of aircraft-supplied data (other than thrust or power command signals from the aircraft) or data shared between engines must:
(amended 2010/01/29)

(1) Not result in a hazardous engine effect for any engine; and
(amended 2010/01/29)

(2) Be detected and accommodated. The accommodation strategy must not result in an unacceptable change in thrust or power or an unacceptable change in engine operating and starting characteristics. The applicant must evaluate and document in the engine installation instructions the effects of these failures on engine power or thrust, engine operability and starting characteristics throughout the flight envelope.
(amended 2010/01/29)

(i) Aircraft-supplied electrical power
(amended 2010/01/29)

(1) The applicant must design the engine control system so that the loss, malfunction, or interruption of electrical power supplied from the aircraft to the engine control system will not result in any of the following:
(amended 2010/01/29)

(i) A hazardous engine effect; or
(amended 2010/01/29)

(ii) The unacceptable transmission of erroneous data.
(amended 2010/01/29)

(2) When an engine dedicated power source is required for compliance with paragraph (i)(1) of this section, its capacity should provide sufficient margin to account for engine operation below idle where the engine control system is designed and expected to recover engine operation automatically.
(amended 2010/01/29)

(3) The applicant must identify and declare the need for and the characteristics of, any electrical power supplied from the aircraft to the engine control system for starting and operating the engine, including transient and steady state voltage limits, in the engine instructions for installation.
(amended 2010/01/29)

(4) Low voltage transients outside the power supply voltage limitations declared in paragraph (i)(3) of this section shall meet the requirements of paragraph (i)(1) of this section. The engine control system must be capable of resuming normal operation when aircraft-supplied power returns to within the declared limits.
(amended 2010/01/29)

(j) Air pressure signal. The applicant must consider the effects of blockage or leakage of the signal lines on the engine control system as part of the System Safety Assessment of (e) of this section and shall adopt the appropriate design precautions.
(amended 2010/01/29)

(k) Automatic availability and control of engine power for 30-second OEI rating. Rotorcraft engines having a 30-second OEI rating shall incorporate a means, or a provision for a means, for automatic availability and automatic control of the 30-second OEI power within its operating limitations.
(amended 2010/01/29)

(l) Engine shut down means. Means must be provided for shutting down the engine rapidly.
(amended 2010/01/29)

(m) Programmable logic devices. The development of programmable logic devices using digital logic or other complex design technologies must provide a level of assurance for the encoded logic commensurate with the hazard associated with the failure or malfunction of the systems in which the devices are located. The applicant must provide evidence that the development of these devices has been done by using a method, approved by the Minister, that is consistent with the criticality of the performed function.
(amended 2010/01/29)

(Change 533-4 (93-12-30))

533.29 *Instrument Connection*

(a) Unless it is constructed to prevent its connection to an incorrect instrument, each connection provided for powerplant instruments required by aircraft airworthiness

regulations or necessary to insure operation of the engine in compliance with any engine limitation must be marked to identify it with its corresponding instrument.

(b) A connection must be provided on each turbojet engine for an indicator system to indicate rotor system unbalance.

(c) Each rotorcraft turbine engine having a 30-second OEI rating and a 2-minute OEI rating must have a means or provision for a means to:
(amended 2010/01/29)

(1) Alert the pilot when the engine is at the 30-second OEI and the 2-minute OEI power levels when the event begins and when the time interval expires;

(2) Automatically record each usage and duration of power at the 30-second OEI and 2-minute OEI levels;
(amended 2010/01/29)

(3) Alert maintenance personnel in a positive manner that the engine has been operated at either or both of the 30-second and 2- minute OEI power levels and permit retrieval of the recorded data; and
(amended 2010/01/29)

(4) Enable routine verification of the proper operation of the above means.
(amended 2010/01/29)

(d) The means or the provision for a means of paragraphs (c)(2) and (c)(3) of this section shall not be capable of being reset in flight.
(amended 2010/01/29)

(e) The applicant must make provision for the installation of instrumentation necessary to ensure operation in compliance with engine operating limitations. Where, in presenting the safety analysis or complying with any other requirement, dependence is placed on instrumentation that is not otherwise mandatory, in the assumed aircraft installation, then the applicant must specify this instrumentation in the engine installation instructions and declare it mandatory in the engine approval documentation.
(amended 2010/01/29)

(f) As part of the System Safety Assessment of 533.28(e), the applicant must assess the possibility and subsequent effect of incorrect fit of instruments, sensors or connectors. Where necessary, the applicant must take design precautions to prevent incorrect configuration of the system.
(amended 2010/01/29)

(g) The sensors, together with associated wiring and signal conditioning, must be segregated, electrically and physically, to the extent necessary to ensure that the probability of a fault propagating from instrumentation and monitoring functions to control functions, or vice

versa, is consistent with the failure effect of the fault.
(amended 2010/01/29)

(h) The applicant must provide instrumentation enabling the flight crew to monitor the functioning of the turbine cooling system unless appropriate inspections are published in the relevant manuals and evidence shows that:
(amended 2010/01/29)

(1) Other existing instrumentation provides adequate warning of failure or impending failure;
(amended 2010/01/29)

(2) Failure of the cooling system would not lead to hazardous engine effects before detection; or
(amended 2010/01/29)

(3) The probability of failure of the cooling system is extremely remote.
(amended 2010/01/29)

(Change 533-5)

SUBCHAPTER C
DESIGN & CONSTRUCTION; RECIPROCATING AIRCRAFT ENGINES

533.31 *Applicability*

This subchapter prescribes additional design and construction requirements for reciprocating aircraft engines.

533.33 *Vibration*

The engine must be designed and constructed to function throughout its normal operating range of crank-shaft rotational speeds and engine powers without inducing excessive stress in any of the engine parts because of vibration and without imparting excessive vibration forces to the aircraft structure.

533.34 *Turbocharger rotors*
(amended 2008/10/30)

Each turbocharger case shall be designed and constructed to be able to contain fragments of a compressor or turbine that fails at the highest speed that is obtainable with normal speed control devices inoperative.
(amended 2008/10/30)

533.35 *Fuel & Induction System*

(a) The fuel system of the engine must be designed and constructed to supply an appropriate mixture of fuel to the cylinders throughout the complete operating range of the engine under all flight and atmospheric conditions.

(b) The intake passages of the engine through which air or fuel in combination with air passes for combustion purposes must be designed and constructed to minimise the danger of ice accretion in those passages. The engine must be designed and constructed to permit the use of a means for ice prevention.

(c) The type and degree of fuel filtering necessary for protection of the engine fuel system against foreign particles in the fuel must be specified. The applicant must show that foreign particles passing through the prescribed filtering means will not critically impair engine fuel system functioning.

(d) Each passage in the induction system that conducts a mixture of fuel and air must be self-draining, to prevent a liquid lock in the cylinders, in all attitudes that the applicant establishes as those the engine can have when the aircraft in which it is installed is in the static ground attitude.

(e) If provided as part of the engine, the applicant must show for each fluid injection (other than fuel) system and its controls that the flow of the injected fluid is adequately controlled.

533.37 *Ignition System*

Each spark ignition engine must have a dual ignition system with at least two spark plugs for each cylinder and two separate electric circuits with separate sources of electrical energy, or have an ignition system of equivalent in-flight reliability.

533.39 *Lubrication System*

(a) The lubrication system of the engine must be designed and constructed so that it will function properly in all flight attitudes and atmospheric conditions in which the aeroplane is expected to operate. In wet sump engines, this requirement must be met when only one-half of the maximum lubricant supply is in the engine.

(b) The lubrication system of the engine must be designed and constructed to allow installing a means of cooling the lubricant.

(c) The crankcase must be vented to the atmosphere to preclude leakage of oil from excessive pressure in the crankcase.

SUBCHAPTER D
BLOCK TESTS
RECIPROCATING AIRCRAFT ENGINES

533.41 *Applicability*

This subchapter prescribes the block tests and inspections for reciprocating aircraft engines.

(Change 533-1 (87-01-01))

533.42 *General*

Before each endurance test required by this subchapter, the adjustment setting and functioning characteristic of each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must be established and recorded.

(Change 533-1 (87-01-01))

533.43 *Vibration Test*

(a) Each engine must undergo a vibration survey to establish the torsional and bending vibration characteristics of the crankshaft and the propeller shaft or other output shaft, over the range of crankshaft speed and engine power, under steady state and transient conditions, from idling speed to either 110 percent of the desired maximum continuous speed rating or 103 percent of the maximum desired take-off speed rating, whichever is higher. The survey must be conducted using, for aeroplane engines, the same configuration of the propeller type which is used for the endurance test, and using, for other engines, the same configuration of the loading device type which is used for the endurance test.

(b) The torsional and bending vibration stresses of the crankshaft and the propeller shaft or other output shaft may not exceed the endurance limit stress of the material from which the shaft is made. If the maximum stress in the shaft cannot be shown to be below the endurance limit by measurement, the vibration frequency and amplitude must be measured. The peak amplitude must be shown to produce a stress below the endurance limit; if not, the engine must be run at the condition producing the peak amplitude until, for steel shafts, 10 million stress reversals have been sustained without fatigue failure and, for other shafts, until it is shown that fatigue will not occur within the endurance limit stress of the material.

(c) Each accessory drive and mounting attachment must be loaded, with the loads imposed by each accessory used only for an aircraft service being the limit load specified by the applicant for the drive or attachment point.

(d) The vibration survey described in paragraph (a) of this section must be repeated with that cylinder not firing which has the most adverse vibration effect, in order to establish the conditions under which the engine can be operated safely in that abnormal state. However,

for this vibration survey, the engine speed range need only extend from idle to the maximum desired take-off speed, and compliance with paragraph (b) of this section need not be shown.

533.45 *Calibration Tests*

(a) Each engine must be subjected to the calibration tests necessary to establish its power characteristics and the conditions for the endurance test specified in 533.49. The results of the power characteristics calibration tests form the basis for establishing the characteristics of the engine over its entire operating range of crankshaft rotational speeds, manifold pressures, fuel/air mixture settings, and altitudes. Power ratings are based upon standard atmospheric conditions with only those accessories installed which are essential for engine functioning.

(b) A power check at sea level conditions must be accomplished on the endurance test engine after the endurance test. Any change in power characteristics which occurs during the endurance test must be determined. Measurements taken during the final portion of the endurance test may be used in showing compliance with the requirements of this paragraph.

533.47 *Detonation Test*

Each engine must be tested to establish that the engine can function without detonation throughout its range of intended conditions of operation.

533.49 *Endurance Test*

(a) General. Each engine must be subjected to an endurance test that includes a total of 150 hours of operation (except as provided in paragraph (e)(1))(iii) of this section) and, depending upon the type and contemplated use of the engine, consists of one of the series of runs specified in paragraphs (b) through (e) of this section, as applicable. The runs must be made in order found appropriate by the Minister for the particular engine being tested. During the endurance test the engine power and the crankshaft rotational speed must be kept within +3 percent of the rated values. During the runs at rated take-off power and for at least 35 hours at rated maximum continuous power, one cylinder, must be operated at not less than the limiting temperature, the other cylinders must be operated at a temperature not lower than 50 degrees F below the limiting temperature, and the oil inlet temperature must be maintained within +10 degrees F of the limiting temperature. An engine that is equipped with a propeller shaft must be fitted for the endurance test with a propeller that thrust-loads the engine to the maximum thrust which the engine is designed to resist at each applicable operating condition specified in this section. Each accessory drive and mounting attachment must be loaded. During operation at rated take-off power and rated maximum continuous power, the load imposed by each accessory used only for an aircraft service must be the limit load specified by the applicant for the engine drive or attachment point.

(b) Unsupercharged engines and engines incorporating a gear-driven single-speed supercharger. For engines not incorporating a super-charger and for engines incorporating a gear-driven single-speed supercharger the applicant must conduct the following runs:

(1) Alternate periods of 5 minutes at rated take-off power with take-off speed, and 5 minutes at maximum best economy cruising power or maximum recommended cruising power.

(2) A 20-hour run consisting of alternate periods of 1 1/2 hours at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 75 percent rated maximum continuous power and 91 percent maximum continuous speed.

(3) A 20-hour run consisting of alternate periods of 1 1/2 hours at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 70 percent rated maximum continuous power at 89 percent maximum continuous speed.

(4) A 20-hour run consisting of alternate periods of 1 1/2 hours at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 65 percent rated maximum continuous power and 87 percent maximum continuous speed.

(5) A 20-hour run consisting of alternate periods of 1 1/2 hours at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 60 percent rated maximum continuous power and 84.5 percent maximum continuous power.

(6) A 20-hour run consisting of alternate periods of 1 1/2 hours at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 50 percent rated maximum continuous power and 79.5 percent maximum continuous speed.

(7) A 20-hour run consisting of alternate periods of 2 1/2 hours at rated maximum continuous power with maximum continuous speed, and 2 1/2 hours at maximum best economy cruising power or at maximum recommended cruising power.

(c) Engines incorporating a gear driven two-speed supercharger. For engines incorporating a gear-driven two-speed supercharger the applicant must conduct the following runs:

(1) A 30-hour run consisting of alternate periods in the lower gear ratio of five minutes at rated take-off power with take-off speed, and five minutes at maximum best economy cruising power or at maximum recommended cruising power. If a take-off power rating is desired in the higher gear ratio, 15 hours of the 30-hour run must be made in the higher gear ratio in alternate periods of five minutes at the observed horsepower obtainable with the take-off critical altitude manifold pressure and take-off speed, and five minutes at 70 percent high ratio rated maximum continuous power and 89 percent high ratio maximum continuous speed.

(2) A 15-hour run consisting of alternate periods in the lower gear ratio of one hour at rated maximum continuous power with maximum continuous power and 91 percent maximum continuous speed.

(3) A 15-hour run consisting of alternate periods in the lower gear ratio of one hour at rated maximum continuous power with maximum continuous speed, and 1/2 hour at 70 percent rated maximum continuous power and 89 percent maximum continuous speed.

(4) A 30-hour run in the higher gear ratio at rated maximum continuous power with maximum continuous speed.

(5) A 5-hour run consisting of alternate periods of five minutes in each of the supercharger gear ratios. The first five minutes of the test must be made at maximum continuous speed in the higher gear ratio and observed horsepower obtainable with 90 percent of maximum continuous manifold pressure in the higher gear ratio under sea level conditions. The condition for operation for the alternate five minutes in the lower gear ratio must be that obtained by shifting to the lower gear ratio at constant speed.

(6) A 10-hour run consisting of alternate periods in the lower gear ratio of one hour at rated maximum continuous power with maximum continuous speed, and one hour at 65 percent rated maximum continuous power and 84.5 percent maximum continuous speed.

(7) A 10-hour run consisting of alternate periods in the lower gear ratio of one hour at rated maximum continuous power with maximum continuous speed, and one hour at 60 percent rated maximum continuous power and 84.5 percent maximum continuous speed.

(8) A 10-hour run consisting of alternate periods in the lower gear ratio of one hour at rated maximum continuous power with maximum continuous speed, and one hour at 50 percent rated maximum continuous power and 79.5 percent maximum continuous speed.

(9) A 20-hour run consisting of alternate periods in the lower gear ratio of 2 hours at rated maximum continuous power with maximum continuous speed, and two hours of maximum best economy cruising power and speed or at maximum recommended cruising power.

(10) A 5-hour run in the lower gear ratio at maximum best economy cruising power and speed or a maximum recommended cruising power and speed.

Where simulated altitude test equipment is not available when operating in the higher gear ratio, the runs may be made at the observed horsepower obtained with the critical altitude manifold pressure or specified percentages thereof, and the fuel-air mixtures may be adjusted to be rich enough to suppress detonation.

(d) Helicopter engines. To be eligible for use on a helicopter each engine must either comply with paragraphs (a) through (j) of 529.923 of this Manual , or must undergo the following series of runs:

(1) A 35-hour run consisting of alternate periods of 30 minutes each at rated take-off power with take-off speed, and at rated maximum continuous power with maximum continuous speed.

(2) A 25-hour run consisting of alternate periods of 2 1/2 hours each at rated maximum continuous power with maximum continuous speed, and at 70 percent rated maximum continuous power with maximum continuous speed.

(3) A 25-hour run consisting of alternate periods of 2 1/2 hours each at rated maximum continuous power with maximum continuous speed, and at 70 percent rated maximum continuous power with 80 to 90 percent maximum continuous speed.

(4) A 25-hour run consisting of alternate periods of 2 1/2 hours each at 80 percent rated maximum continuous power with take-off speed, and at 80 percent rated maximum continuous power with 80 to 90 percent maximum continuous speed.

(5) A 25-hour run consisting of alternate periods of 2 1/2 hours each 80 percent rated maximum continuous power with take-off speed, and at either rated maximum continuous power with 110 percent maximum continuous speed or at rated take-off power with 103 percent take-off speed, whichever results in the greater speed.

(6) A 15-hour run at 105 percent rated maximum continuous power with 105 percent maximum continuous speed or at full throttle and corresponding speed at standard sea level carburettor entrance pressure, if 105 percent of the rated maximum continuous power is not exceeded.

(e) Turbosupercharged engines. For engines incorporating a turbosupercharger the following apply except that altitude testing may be simulated provided the applicant shows that the engine and supercharger are being subjected to mechanical loads and operating temperatures no less severe than if run at actual altitude conditions.

(1) For engines used in aeroplanes the applicant must conduct the runs specified in paragraph (b) of this section, except:

(i) The entire run specified in subparagraph (b)(1) of this section must be made at sea level altitude pressure;

(ii) The portions of the runs specified in subparagraph (b)(2) through (7) of this section at rated maximum continuous power must be made at critical altitude pressure, and the portions of the runs at other power must be made at 8,000 feet altitude pressure; and

(iii) The turbosupercharger used during the 150-hour endurance test must be run on the bench for an additional 50 hours at the limiting turbine wheel inlet gas temperature and rotational speed for rated maximum continuous power operation unless the limiting temperature and of the rated maximum continuous power operation.

(2) For engines used in helicopters and applicant must conduct the runs specified in paragraph (d) of this section, except:

(i) The entire run specified in paragraph (d)(1) of this section must be made at critical altitude pressure;

(ii) The portions of the runs specified in paragraph (d)(2) and of this section at rated maximum continuous power must be made at critical altitude pressure and the portions of the runs at other power must be made at 8,000 feet altitude pressure;

(iii) The entire run specified in paragraph (d)(4) of this section must be made at 8,000 feet altitude pressure;

(iv) The portion of the runs specified in paragraph (d)(5) of this section at 80 percent of rated maximum continuous power must be made at 8,000 feet altitude pressure and the portions of the runs at other power must be made at critical altitude pressure;

(v) The entire run specified in paragraph (d)(6) of this section must be made at critical altitude pressure; and

(vi) The turbosupercharger used during the endurance test must be run on the bench for 50 hours at the limiting turbine wheel inlet gas temperature and rotational speed for rated maximum continuous power operation unless the limiting temperature and speed are maintained during 50 hours of the rated maximum continuous power operation.

(Change 533-1 (87-01-01))

533.51 *Operation Test*

The operation test must include the testing found necessary by the Minister to demonstrate backfire characteristics, starting, idling, acceleration, overspeeding, functioning of propeller and ignition, and any other operational characteristic of the engine. If the engine incorporates a multispeed super-charger driver, the design and construction must allow the supercharger to be shifted from operation at the lower speed ratio to the higher and the power appropriate to the manifold pressure and speed settings for rated maximum continuous power at the higher supercharger speed ratio must be obtainable within five seconds.

533.53 *Engine System and Component Tests*
(amended 2010/01/29)

(a) For those systems and components that cannot be adequately substantiated in accordance with endurance testing of 533.49, the applicant must conduct additional tests to demonstrate that systems or components are able to perform the intended functions in all declared environmental and operating conditions.
(amended 2010/01/29)

(b) Temperature limits must be established for each component that requires temperature controlling provisions in the aircraft installation to assure satisfactory functioning, reliability, and durability.

533.55 *Teardown Inspection*

After completing the endurance test:

(a) Each engine must be completely disassembled;

(b) Each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must retain each setting and functioning characteristic within the limits that were established and recorded at the beginning of the test; and

(c) Each engine component must conform to the type design and be eligible for incorporation into an engine for continued operation, in accordance with information submitted in compliance with 533.4.

(Change 533-1 (87-01-01))

533.57 *General Conduct of Block Tests*

(a) The applicant may, in conducting the block tests, use separate engines of identical design and construction in the vibration, calibration, detonation, endurance, and operation tests, except that, if a separate engine is used for the endurance test it must be subjected to a calibration check before starting the endurance test.

(b) The applicant may service and make minor repairs to the engine during the block tests in accordance with the service and maintenance instructions submitted in compliance with 533.4. If the frequency of the service is excessive, or the number of stops due to engine malfunction is excessive, or a major repair, or replacement of a part is found necessary during the block tests or as a result of findings from the teardown inspection, the engine or its parts may be subjected to any additional test the Minister finds necessary.

(c) Each applicant must furnish all testing facilities, including equipment and competent personnel, to conduct the block tests.

SUBCHAPTER E
DESIGN AND CONSTRUCTION TURBINE AIRCRAFT ENGINES

533.61 *Applicability*

This subchapter prescribes additional design and construction requirements for turbine aircraft engines.

(Change 533-1 (87-01-01))

533.62 *Stress Analysis*

A stress analysis must be performed on each turbine engine showing the design safety margin of each turbine engine rotor, spacer, and rotorshaft.

533.63 *Vibration*

Each engine must be designed and constructed to function throughout its declared flight envelope and operating range of rotational speeds and power/thrust, without inducing excessive stress in any engine part because of vibration and without imparting excessive vibration forces to the aircraft structure.

(Change 533-5)

533.64 *Pressurized Engine Static Parts*
(amended 2010/01/29)

(a) Strength. The applicant must establish by test, validated analysis, or a combination of both, that all static parts subject to significant gas or liquid pressure loads for a stabilized period of one minute will not:
(amended 2010/01/29)

(1) Exhibit permanent distortion beyond serviceable limits or exhibit leakage that could create a hazardous condition when subjected to the greater of the following pressures:
(amended 2010/01/29)

(i) 1.1 times the maximum working pressure;
(amended 2010/01/29)

(ii) 1.33 times the normal working pressure; or
(amended 2010/01/29)

(iii) 35 kPa (5 p.s.i.) above the normal working pressure.
(amended 2010/01/29)

(2) Exhibit fracture or burst when subjected to the greater of the following pressures:
(amended 2010/01/29)

(i) 1.15 times the maximum possible pressure;
(amended 2010/01/29)

(ii) 1.5 times the maximum working pressure; or
(amended 2010/01/29)

(iii) 35 kPa (5 p.s.i.) above the maximum possible pressure.
(amended 2010/01/29)

(b) Compliance with this section must take into account:
(amended 2010/01/29)

(1) The operating temperature of the part;
(amended 2010/01/29)

(2) Any other significant static loads in addition to pressure loads;
(amended 2010/01/29)

(3) Minimum properties representative of both the material and the processes used in the construction of the part; and
(amended 2010/01/29)

(4) Any adverse geometry conditions allowed by the type design.
(amended 2010/01/29)

533.65 *Surge & Stall Characteristics*

When the engine is operated in accordance with operating instructions required by 533.5(b), starting, a change of power or thrust, power or thrust augmentation, limiting inlet air distortion, or inlet air temperature may not cause surge or stall to the extent that flameout, structural failure, overtemperature, or failure of the engine to recover power or thrust will occur at any point in the operating envelope.

533.66 *Bleed Air System*

The engine must supply bleed air without adverse effect on the engine, excluding reduced thrust or power output, at all conditions set up to the discharge flow conditions established as a limitation under 533.7(c)(11). If bleed air used for engine anti-icing can be controlled, provision must be made for a means to indicate the functioning of the engine ice protection system.

533.67 *Fuel System*

(a) With fuel supplied to the engine at the flow and pressure specified by the applicant, the engine must function properly under each operating condition required by this Chapter. Each fuel control adjusting means that may not be manipulated while the fuel control device is mounted on the engine must be secured by a locking device and sealed, or otherwise be inaccessible. All other fuel control adjusting means must be accessible and marked to indicate the functioning of the adjustment unless the function is obvious.

(b) There must be a fuel strainer or filter between the engine fuel inlet opening and the inlet of either the fuel metering device or the engine-driven positive displacement pump whichever is nearer the engine fuel inlet. In addition, the following provisions apply to each strainer or filter required by this paragraph:

(1) It must be accessible for draining and cleaning and must incorporate a screen or element that is easily removable.

(2) It must have a sediment trap and drain except that it need not have a drain if the strainer or filter is easily removable for drain purposes.

(3) It must be mounted so that its weight is not supported by the connecting lines or by the inlet or outlet connections of the strainer or filter, unless adequate strength margins under all loading conditions are provided in the lines and connections.

(4) It must have the type and degree of fuel filtering specified as necessary for protection of the engine fuel system against foreign particles in the fuel. The applicant must show:

(i) That foreign particles passing through the specified filtering means do not impair the engine fuel system functioning; and

(ii) That the fuel system is capable of sustaining operation through-out its flow and pressure range with the fuel initially saturated with water at 80°F (27°C) and having 0.025 fluid ounces per gallon (0.20 millilitres per litre) of free water added and cooled to the most critical condition for icing likely to be encountered in operation. However; this requirement may be met by demonstrating the effectiveness of specified approved fuel anti-icing additives, or that the fuel system incorporates a fuel heater which maintains the fuel temperature at the fuel strainer or fuel inlet above 32°F (0°C) under the most critical conditions.

(5) The applicant must demonstrate that the filtering means has the capacity (with respect to engine operating limitations) to ensure that the engine will continue to operate within approved limits, with fuel contaminated to the maximum degree of particle size and density likely to be encountered in service. Operation under these conditions must be demonstrated for a period acceptable to the Minister, beginning when indication of impending filter blockage is first given by either:

(i) Existing engine instrumentation; or

(ii) Additional means incorporated into the engine fuel system.

(6) Any strainer or filter bypass must be designed and construction so that the release of collected contaminants is minimised by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path.

(c) If provided as part of the engine, the applicant must show for each fluid injection (other than fuel) system and its controls that the flow of the injected fluid is adequately controlled.

(d) Rotorcraft engines having a 30-second OEI rating must incorporate a means or a provision for a means for automatic availability and automatic control of the 30-second OEI power within its operating limitations.
(amended 2010/01/29)

(Change 533-5)

533.68 *Induction System Icing*

Each engine, with all icing protection systems operating, must:

(a) Operate throughout its flight power range (including idling) with out the accumulation of ice on the engine components that adversely affects engine operation or that causes a serious loss of power or thrust in continuous maximum and intermittent maximum icing conditions as defined in Appendix C of Chapter 525 of this Manual; and

(b) Idle for 30 minutes on the ground, with the available air bleed for icing protection at its critical condition, without adverse effect, in an atmosphere that is at a temperature between 15° and 30°F (between -9° and -1°C) and has a liquid water content not less than 0.3 grams per cubic metre in the form of drops having a mean effective diameter not less than 20 microns, followed by a momentary operation at take-off power or thrust. During the 30 minutes of idle operation the engine may be run up periodically to a moderate power or thrust setting in a manner acceptable to the Minister.

533.69 *Ignitions System*

Each engine must be equipped with an ignition system for starting the engine on the ground and in flight. An electric ignition system must have at least two igniter and two separate secondary electric circuits, except that only one igniter is required for fuel burning augmentation systems.

533.70 *Engine Life-limited Parts*
(amended 2008/10/30)

By a procedure approved by the Minister, operating limitations shall be established which specify the maximum allowable number of flight cycles for each engine life-limited part. Engine life-limited parts are rotor and major static structural parts whose primary failure is likely to result in a hazardous engine effect. Typically, engine life-limited parts include, but are not limited to disks, spacers, hubs, shafts, high-pressure casings, and non-redundant mount components. For the purposes of this section, a hazardous engine effect is any of the conditions listed in 533.75. The applicant will establish the integrity of each engine life-limited part by:
(amended 2008/10/30)

(a) An engineering plan that contains the steps required to ensure each engine life-limited part is withdrawn from service at an approved life before hazardous engine effects can occur. These steps include validated analysis, test or service experience which ensures that the combination of loads, material properties, environmental influences and operating conditions, including the effects of other engine parts influencing these parameters, are sufficiently well known and predictable so that the operating limitations can be established and maintained for

each engine life-limited part. Applicants shall perform appropriate damage tolerance assessments to address the potential for failure from material, manufacturing and service induced anomalies within the approved life of the part. Applicants shall publish a list of the life-limited engine parts and the approved life for each part in the Airworthiness Limitations Section of the Instructions for Continued Airworthiness as required by 533.4.
(amended 2008/10/30)

(b) A manufacturing plan that identifies the specific manufacturing constraints necessary to consistently produce each engine life-limited part with the attributes required by the engineering plan.
(amended 2008/10/30)

(c) A service management plan that defines in-service processes for maintenance and the limitations to repair for each engine life-limited part that will maintain attributes consistent with those required by the engineering plan. These processes and limitations will become part of the Instructions for Continued Airworthiness.
(amended 2008/10/30)

533.71 *Lubrication System*

(a) General. Each lubrication system must function properly in the flight attitudes and atmospheric conditions in which an aircraft is expected to operate.

(b) Oil strainer or filter. There must be an oil strainer or filter through which all of the engine oil flows. In addition:

(1) Each strainer or filter required by this paragraph that has a bypass must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer of filter element completely blocked.

(2) The type and degree of filtering necessary for protection of the engine oil system against foreign particles in the oil must be specified. The applicant must demonstrate that foreign particles passing through the specified filtering means do not impair engine oil system functioning.

(3) Each strainer or filter required by this paragraph must have the capacity (with respect to operating limitations established for the engine) to ensure that engine oil system functioning is not impaired with the oil contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine in subparagraph (2) of this paragraph.

(4) For each strainer or filter required by this paragraph, except the strainer or filter at the oil tank outlet, there must be means to indicate contamination before it reaches the capacity established in accordance with paragraph (b)(3) of this section.

(5) Any filter bypass must be designed and constructed so that the release of collected contaminants is minimised by appropriate location of the bypass to ensure that the collected contaminants are not in the bypass flow path.

(6) Each strainer or filter required by this paragraph that has no bypass, except the strainer or filter at an oil tank outlet or for a scavenge pump, must have provisions for connection with a warning means to warn the pilot of the occurrence of contamination of the screen before it reaches the capacity established in accordance with subparagraph (3) of this paragraph.

(7) Each strainer or filter required by this paragraph must be accessible for draining and cleaning.

(c) Oil tanks.

(1) Each oil tank must have an expansion space for not less than 10 percent of the tank capacity.

(2) It must be impossible to inadvertently fill the oil tank expansion space.

(3) Each recessed oil tank filler connection that can retain any appreciable quantity of oil must have provision for fitting a drain.

(4) Each oil tank cap must provide an oil-tight seal.

(5) Each oil tank filler must be marked with the word “oil”.

(6) Each oil tank must be vented from the top part of the expansion space, with the vent so arranged that condensed water vapour that might freeze and obstruct the line cannot accumulate at any point.

(7) There must be means to prevent entrance into the oil tank or into any oil tank outlet, of any object that might obstruct the flow of oil through the system.

(8) There must be a shut-off valve at the outlet of each oil tank, unless the external portion of the oil system (including oil tank supports) is fireproof.

(9) Each unpressurised oil tank must not leak when subjected to a maximum operating temperature and an internal pressure of 5 p.s.i., and each pressured oil tank must meet the requirements of 533.64.
(amended 2010/01/29)

(10) Leaked or spilled oil may not accumulate between the tank and the remainder of the engine.

(11) Each oil tank must have an oil quantity indicator or provision for one.

(12) If the propeller feathering system depends on engine oil:

(i) There must be means to trap an amount of oil in the tank if the supply becomes depleted due to failure of any part of the lubricating system other than the tank itself.

(ii) The amount of trapped oil must be enough to accomplish the feathering operation and must be available only to the feathering pump; and

(iii) Provision must be made to prevent sludge or other foreign matter from affecting the safe operation of the propeller feathering system.

(d) Oil Drains. A drain (or drains) must be provided to allow safe drainage of the oil system.

Each drain must:

(1) Be accessible; and

(2) Have manual or automatic means for positive locking in the closed position.

(e) Oil radiators. Each oil radiator must withstand, without failure, any vibration, inertia, and oil pressure load to which it is subjected during the block tests.

533.72 *Hydraulic Actuating Systems*

Each hydraulic actuating system must function properly under all conditions in which the engine is expected to operate. Each filter or screen must be accessible for servicing and each tank must meet the design criteria of 533.71.

533.73 *Power or Thrust Response*

The design and construction of the engine must enable an increase:

(a) From minimum to rated take-off power or thrust with the maximum bleed air and power extraction to be permitted in an aircraft, without overtemperature, surge, stall, or other detrimental factors occurring to the engine whenever the power control lever is moved from the minimum to the maximum position in not more than 1 second, except that the Minister may allow additional time increments for different regimes of control operation requiring control scheduling; and

(b) From the fixed minimum flight idle power lever position when provided, or if not provided, from not more than 15% of the rated take-off power or thrust available to 95% rated take-off power or thrust is not over 5 seconds. The 5-second power or thrust response must occur from a stabilised static condition using only the bleed air and accessories loads necessary to run the engine. This take-off rating is specified by the applicant and need not include thrust augmentation.

533.74 *Continued Rotation*

If any of the engine main rotating systems continue to rotate after the engine is shutdown for any reason while in flight, and if means to prevent that continued rotation are not provided, then any continued rotation during the maximum period of flight, and in the flight conditions expected to occur with that engine inoperative, shall not result in any condition described

in 533.75 (g)(2)(i) through (vi) of this chapter.
(amended 2008/10/30)

(Change 533-5)

533.75 *Safety Analysis*

(a)
(amended 2008/10/30)

(1) The applicant shall analyze the engine, including the control system, to assess the likely consequences of all failures that can reasonably be expected to occur. This analysis will take into account, if applicable:
(amended 2008/10/30)

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions shall be stated in the analysis;
(amended 2008/10/30)

(ii) Consequential secondary failures and latent failures;
(amended 2008/10/30)

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section.
(amended 2008/10/30)

(2) The applicant shall summarize those failures that could result in major engine effects or hazardous engine effects, as defined in paragraph (g) of this section, and estimate the probability of occurrence of those effects. Any engine part the failure of which could reasonably result in a hazardous engine effect shall be clearly identified in this summary.
(amended 2008/10/30)

(3) The applicant shall show that hazardous engine effects are predicted to occur at a rate not in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). Since the estimated probability for individual failures may be insufficiently precise to enable the applicant to assess the total rate for hazardous engine effects, compliance may be shown by demonstrating that the probability of a hazardous engine effect arising from an individual failure can be predicted to be no greater than 10^{-8} per engine flight hour. In dealing with probabilities of this low order of magnitude, absolute proof is not possible and compliance may be shown by reliance on engineering judgment and previous experience combined with sound design and test philosophies.
(amended 2008/10/30)

(4) The applicant shall show that major engine effects are predicted to occur at a rate not in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour).
(amended 2008/10/30)

(b) The Minister may require that any assumption as to the effects of failures and likely combination of failures be verified by test.
(amended 2008/10/30)

(c) The primary failure of certain single elements cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, then compliance may be shown by reliance on the prescribed integrity requirements of 533.15, 533.27 and 533.70 as applicable. These instances shall be stated in the safety analysis.
(amended 2008/10/30)

(d) If reliance is placed on a safety system to prevent a failure from progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure shall be included in the analysis. Such a safety system may include safety devices, instrumentation, early warning devices, maintenance checks, and other similar equipment or procedures. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts shall be clearly stated in the analysis and identified in the installation instructions under 533.5 of this chapter.
(amended 2008/10/30)

(e) If the safety analysis depends on one or more of the following items, those items shall be identified in the analysis and appropriately substantiated.
(amended 2008/10/30)

(1) Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items that could fail in a latent manner. When necessary to prevent hazardous engine effects, these maintenance actions and intervals shall be published in the instructions for continued airworthiness required under 533.4 of this chapter. Additionally, if errors in maintenance of the engine, including the control system, could lead to hazardous engine effects, the appropriate procedures shall be included in the relevant engine manuals.
(amended 2008/10/30)

(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning shall be published in the appropriate manual.
(amended 2008/10/30)

(3) The provisions of specific instrumentation not otherwise required.
(amended 2008/10/30)

(4) Flight crew actions to be specified in the operating instructions established under 533.5.
(amended 2008/10/30)

(f) If applicable, the safety analysis shall also include, but not be limited to, investigation of the following:
(amended 2008/10/30)

(1) Indicating equipment;
(amended 2008/10/30)

(2) Manual and automatic controls;
(amended 2008/10/30)

(3) Compressor bleed systems;
(amended 2008/10/30)

(4) Refrigerant injection systems;
(amended 2008/10/30)

(5) Gas temperature control systems;
(amended 2008/10/30)

(6) Engine speed, power or thrust governors and fuel control systems;
(amended 2008/10/30)

(7) Engine overspeed, overtemperature or topping limiters;
(amended 2008/10/30)

(8) Propeller control systems; and
(amended 2008/10/30)

(9) Engine or propeller thrust reversal systems.
(amended 2008/10/30)

(g) Unless otherwise approved by the Minister and stated in the safety analysis, for compliance with chapter 533, the following failure definitions apply to the engine:
(amended 2008/10/30)

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine will be regarded as a minor engine effect.
(amended 2008/10/30)

(2) The following effects will be regarded as hazardous engine effects:
(amended 2008/10/30)

(i) Non-containment of high-energy debris;
(amended 2008/10/30)

(ii) Concentration of toxic products in the engine bleed air intended for the cabin sufficient to incapacitate crew or passengers;
(amended 2008/10/30)

(iii) Significant thrust in the opposite direction to that commanded by the pilot;
(amended 2008/10/30)

(iv) Uncontrolled fire;
(amended 2008/10/30)

(v) Failure of the engine mount system leading to inadvertent engine separation;
(amended 2008/10/30)

(vi) Release of the propeller by the engine, if applicable; and
(amended 2008/10/30)

(vii) Complete inability to shut the engine down.
(amended 2008/10/30)

(3) An effect whose severity falls between those effects covered in paragraphs (g)(1) and (g)(2) of this section will be regarded as a major engine effect.
(amended 2008/10/30)

533.76 *Bird Ingestion*
(amended 2001/03/05)

(a) **General**

Compliance with (b), (c) and (d) of this section shall be in accordance with the following:
(amended 2008/10/30)

(1) except as specified in paragraph (d) of this section, all ingestion tests shall be conducted with the engine stabilized at no less than 100-percent take-off power or thrust, for test day ambient conditions prior to the ingestion. In addition, the demonstration of compliance shall account for engine operation at sea level take-off conditions on the hottest day that a minimum engine can achieve maximum rated take-off thrust or power;
(amended 2008/10/30)

(2) the engine inlet throat area as used in this section to determine the bird quantity and weights shall be established by the applicant and identified as a limitation in the installation instructions required under section 533.5;

(3) the impact to the front of the engine from the large single bird, the single largest medium bird which can enter the inlet and the large flocking bird shall be evaluated. Applicants shall demonstrate that the associated components when struck under the conditions prescribed in paragraphs (b), (c) or (d) of this section, as applicable, will not affect the engine to the extent that the engine cannot comply with the requirements of (b)(3), (c)(6) and (d)(4) of this section;
(amended 2008/10/30)

(4) for an engine that incorporates an inlet protection device, compliance with this section shall be established with the device functioning. The engine approval shall be endorsed to demonstrate that compliance with the requirements has been established with the device functioning;

(5) objects that are accepted by the Minister may be substituted for birds when conducting the bird ingestion tests required by (b), (c) and (d) of this section; and (amended 2008/10/30)

(6) if compliance with the requirements of this section is not established, the engine type certification documentation shall demonstrate that the engine shall be limited to aircraft installations in which it is demonstrated that a bird cannot strike the engine, or be ingested into the engine, or adversely restrict airflow into the engine.

(b) **Large single birds**
(amended 2008/10/30)

Compliance with the large bird ingestion requirements shall be in accordance with the following:
(amended 2008/10/30)

(1) the large bird ingestion test shall be conducted using one bird of a weight determined from Table 1 aimed at the most critical exposed location on the first stage rotor blades and ingested at a bird speed of 200-knots for engines to be installed on aeroplanes, or the maximum airspeed for normal rotorcraft flight operations for engines to be installed on rotorcraft;

(2) power lever movement shall not be permitted within 15 seconds following ingestion of the large bird;

(3) ingestion of a single large bird tested under the conditions prescribed in this section shall not result in any condition described in 533.75(g)(2) of this chapter.
(amended 2008/10/30)

(4) compliance with the large bird ingestion requirements of this paragraph may be established by demonstrating that the requirements of 533.94(a) constitute a more severe demonstration of blade containment and rotor unbalance than the requirements of this paragraph.

Table 1 to 533.76 -- Large Bird Weight Requirements

Engine Inlet Throat Area (A)-Square-meters (square-inches)	Bird weight kg (lb)
1.35 (2,092)> A.....................	1.85 (4.07) minimum, unless a smaller bird is determined to be a more severe demonstration.
1.35 (2,092) ≤A <3.90(6,045) (amended 2004/06/08)	2.75 (6.05)
3.90 (6,045) ≤A	3.65 (8.03)

(c) **Small and medium flocking birds**
(amended 2008/10/30)

Compliance with the small and medium bird ingestion requirements shall be in accordance with the following:
(amended 2008/10/30)

(1) analysis or component test, or both, acceptable to the Minister, shall be conducted to determine the critical ingestion parameters affecting power loss and damage. Critical ingestion parameters shall include, but are not limited to, the effects of bird speed, critical target location, and first stage rotor speed. The critical bird ingestion speed should reflect the most critical condition within the range of airspeeds used for normal flight operations up to 1,500 feet above ground level, but not less than V_1 minimum for aeroplanes;
(amended 2004/06/08)

(2) medium bird engine tests shall be conducted so as to simulate a flock encounter, and will use the bird weights and quantities specified in Table 2. When only one bird is specified, that bird will be aimed at the engine core primary flow path; the other critical locations on the engine face area must be addressed, as necessary, by appropriate tests or analysis, or both. When two or more birds are specified in Table 2, the largest of those birds shall be aimed at the engine core primary flow path, and a second bird shall be aimed at the most critical exposed location on the first stage rotor blades. Any remaining birds shall be evenly distributed over the engine face area;

(3) in addition, except for rotorcraft engines, it shall also be substantiated by appropriate tests or analysis or both, that when the full fan assembly is subjected to the ingestion of the quantity and weights of bird from Table 3, aimed at the fan assembly's most critical location outboard of the primary core flowpath, and in accordance with the applicable test conditions of this paragraph, that the engine can comply with the acceptance criteria of this paragraph;

(4) a small bird ingestion test is not required if the prescribed number of medium birds pass into the engine rotor blades during the medium bird test;

(5) small bird ingestion tests shall be conducted so as to simulate a flock encounter using one 85 gram (0.187 lb.) bird for each 0.032 square-meter (49.6 square-inches) of inlet area, or fraction thereof, up to a maximum of 16 birds. The birds shall be aimed so as to account for any critical exposed locations on the first stage rotor blades, with any remaining birds evenly distributed over the engine face area;

(6) ingestion of small and medium birds tested under the conditions prescribed in this paragraph shall not cause any of the following:

(i) more than a sustained 25-percent power or thrust loss,

(ii) the engine to be shut down during the required run-on demonstration prescribed in paragraphs (c)(7) or (c)(8) of this section,

(iii) the conditions defined in paragraph (b)(3) of this section, and

(iv) unacceptable deterioration of engine handling characteristics;

(7) except for rotorcraft engines, the following test schedule shall be used:

(i) ingestion so as to simulate a flock encounter, with approximately 1 second elapsed time from the moment of the first bird ingestion to the last,

(ii) followed by 2 minutes without power lever movement after the ingestion, (amended 2004/06/08)

(iii) followed by 3 minutes at 75-percent of the test condition,

(iv) followed by 6 minutes at 60-percent of the test condition,

(v) followed by 6 minutes at 40-percent of the test condition,

(vi) followed by 1 minute at approach idle,

(vii) followed by 2 minutes at 75-percent of the test condition,

(viii) followed by stabilising at idle and engine shut down, and

(ix) the durations specified are times at the defined conditions with the power being changed between each condition in less than 10 seconds; and
(amended 2004/06/08)

(8) for rotorcraft engines, the following test schedule shall be used:

(i) ingestion so as to simulate a flock encounter within approximately 1 second elapsed time between the first ingestion and the last,

(ii) followed by 3 minutes at 75-percent of the test condition,

(iii) followed by 90 seconds at descent flight idle,

(iv) followed by 30 seconds at 75-percent of the test condition, and

(v) followed by stabilizing at idle and engine shut down, and
(amended 2004/06/08)

(vi) the durations specified are times at the defined conditions with the power being changed between each condition in less than 10 seconds, and
(amended 2004/06/08)

(9) engines intended for use in multi-engine rotorcraft are not required to comply with the medium bird ingestion portion of this section, providing that the appropriate type certificate documentation is so endorsed; and

(10) if any engine operating limit(s) is exceeded during the initial 2 minutes without power lever movement, as provided by paragraph (c)(7)(ii) of this section, then it shall be established that the limit exceedence will not result in an unsafe condition.

Table 2 to 533.76 -- Medium Flocking Bird Weight and Quantity Requirements

Engine Inlet Throat Area (A) -- Square-meters (square-inches)	Bird quantity	Bird weight kg (lb)
0.05 (77.5) >A	none	
0.05 (77.5) ≤A <0.10((155)	1	0.35 (0.77)
0.10 (155) ≤A <0.20 (310)	1	0.45 (0.99)
0.20 (310) ≤A <0.40 (620)	2	0.45 (0.99)
0.40 (620) ≤A <0.60 (930)	2	0.70 (1.54)
0.60 (930) ≤A <1.00 (1,550)	3	0.70 (1.54)
1.00 (1,550) ≤A ≤1.35 (2,092)	4	0.70 (1.54)
1.35 (2,092) ≤A <1.70 (2,635)	1	1.15 (2.53)
	plus 3	0.70 (1.54)
1.70 (2,635) ≤A <2.10 (3,255)	1	1.15 (2.53)
	plus 4	0.70 (1.54)
2.10 (3,255) ≤A <2.50 (3,875)	1	1.15 (2.53)
	plus 5	0.70 (1.54)
2.50 (3,875) ≤A <3.90 (6045)	1	1.15 (2.53)
	plus 6	0.70 (1.54)
3.90 (6,045) ≤A <4.50 (6975)	3	1.15 (2.53)
4.50 (6,975) ≤A	4	1.15 (2.53)

Table 3 to 533.76 -- Additional Integrity Assessment

Engine Inlet Throat Area (A) -- square-meters (square-inches)	Bird quantity	Bird weight kg (lb)
1.35 (2,092)>A	none	
1.35 (2,092) ≤A <2.90 (4,495)	1	1.15(2.53)
2.90 (4,495) ≤A <3.90 (6,045)	2	1.15 (2.53)
3.90 (6,045) ≤A	1	1.15 (2.53)
	plus 6	0.70 (1.54)

(d) **Large flocking bird**
(amended 2008/10/30)

An engine test will be performed as follows:
(amended 2008/10/30)

(1) large flocking bird engine tests must be performed using the bird mass and weights in Table 4 and ingested at a bird speed of 200 knots.
(amended 2008/10/30)

(2) prior to the ingestion, the engine shall be stabilized at no less than the mechanical rotor speed of the first exposed stage or stages that, on a standard day, would produce 90 percent of the sea level static maximum rated take-off power or thrust.
(amended 2008/10/30)

(3) the bird shall be targeted on the first exposed rotating stage or stages at a blade airfoil height of no less than 50 percent measured at the leading edge.
(amended 2008/10/30)

(4) ingestion of a large flocking bird under the conditions prescribed in (d)(1), (d)(2) and (d)(3) shall not cause any of the following:
(amended 2008/10/30)

(i) a sustained reduction of power or thrust to less than 50 percent of maximum rated take-off power or thrust during the run-on segment specified under (d)(5)(i) of this section.
(amended 2008/10/30)

(ii) engine shutdown during the required run-on demonstration specified in (d)(5) of this section.
(amended 2008/10/30)

(iii) the conditions specified in (b)(3) of this section.
(amended 2008/10/30)

(5) the following test schedule shall be used:
(amended 2008/10/30)

(i) ingestion followed by 1 minute without power lever movement.
(amended 2008/10/30)

(ii) followed by 13 minutes at no less than 50 percent of maximum rated take-off power or thrust.
(amended 2008/10/30)

(iii) followed by 2 minutes between 30 and 35 percent of maximum rated take-off power or thrust.
(amended 2008/10/30)

(iv) followed by 1 minute with power or thrust increased from that set in (d)(5)(iii) of this section, by between 5 and 10 percent of maximum rated take-off power or thrust.
(amended 2008/10/30)

(v) followed by 2 minutes with power or thrust reduced from that set in (d)(5)(iv) of this section, by between 5 and 10 percent of maximum rated take-off power or thrust.
(amended 2008/10/30)

(vi) followed by a minimum of 1 minute at ground idle then engine shutdown. The durations specified are times at the defined conditions. Power lever movement between each condition will be 10 seconds or less, except that power lever movements allowed within (d)(5)(ii) of this section are not limited, and for setting power under (d)(5)(iii) of this section will be 30 seconds or less.
(amended 2008/10/30)

(6) compliance with the large flocking bird ingestion requirements of (d) may also be demonstrated by:
(amended 2008/10/30)

(i) incorporating the requirements of (d)(4) and (d)(5) of this section, into the large single bird test demonstration specified in (b)(1) of this section; or
(amended 2008/10/30)

(ii) use of an engine subassembly test at the ingestion conditions specified in (b)(1) of this section if:
(amended 2008/10/30)

(A) all components critical to complying with the requirements of (d) of this section are included in the subassembly test;
(amended 2008/10/30)

(B) the components of (d)(6)(ii)(A) of this section are installed in a representative engine for a run-on demonstration in accordance with (d)(4) and (d)(5) of this section; except that (d)(5)(i) is deleted and (d)(5)(ii) shall be 14 minutes in duration after the engine is started and stabilized; and
(amended 2008/10/30)

(C) the dynamic effects that would have been experienced during a full engine ingestion test can be demonstrated to be negligible with respect to meeting the requirements of (d)(4) and (d)(5) of this section.
(amended 2008/10/30)

(7) applicants shall demonstrate that an unsafe condition will not result if any engine operating limit is exceeded during the run-on period.
(amended 2008/10/30)

Table 4 to 533.76 -- Large Flocking Bird Mass and Weight
(amended 2008/10/30)

Engine Inlet Throat Area (A) -- square-meters (square-inches)	Bird quantity	Bird mass and weight kg (lbs)
A < 2.50 (3,875)	none	
2.50 (3,875) ≤ A < 3.50 (5,425)	1	1.85 (4.08)

Engine Inlet Throat Area (A) -- square-meters (square-inches)	Bird quantity	Bird mass and weight kg (lbs)
3.50 (5,425) ≦ A < 3.90 (6,045)	1	2.10 (4.63)
3.90 (6,045) ≦ A	1	2.50 (5.51)
		(amended 2008/10/30)

533.77 ***Foreign Object Ingestion - Ice***
(amended 2001/03/05)

(a) Reserved.
(amended 2001/03/05)

(b) Reserved.
(amended 2001/03/05)

(c) Ingestion of ice under the conditions of paragraph (e) of this section may not
(amended 2001/03/05)

(1) cause a sustained power or thrust loss; or
(amended 2001/03/05)

(2) require the engine to be shut down.
(amended 2001/03/05)

(d) For an engine that incorporates protection device, compliance with a this section need not be demonstrate with respect to foreign objects to be ingested under the conditions prescribed in paragraph (e) of this section if it is shown that:

(1) Such foreign objects are of a size that will not pass through the protective device;

(2) The protective device will withstand the impact of the foreign objects; and

(3) the foreign object, or objects, stopped by the protective device shall not obstruct the flow of induction air into the engine with a resultant sustained reduction in power or thrust greater than those values required by paragraph (c) of this section.
(amended 2001/03/05)

(e) Compliance with paragraph (c) of this section shall be demonstrated by engine test under the following ingestion conditions:
(amended 2001/03/05)

(1) ice quantity shall be the maximum accumulation on a typical inlet cowl and engine face resulting from a 2-minute delay in actuating the anti-icing system; or a slab of ice which is comparable in weight or thickness for that size engine;
(amended 2001/03/05)

(2) the ingestion velocity shall simulate ice being sucked into the engine inlet;
(amended 2001/03/05)

(3) engine operation shall be maximum cruise power or thrust; and
(amended 2001/03/05)

(4) the ingestion shall simulate a continuous maximum icing encounter at 25 degress Fahrenheit.
(amended 2001/03/05)

(Change 533-5)

533.78 *Rain and Hail Ingestion*

(a) All engines.

(1) The ingestion of large hailstones (0.8 to 0.9 specific gravity) at the maximum true air speed, up to 15,000 feet (4,500 meters), associated with a representative aircraft operating in rough air, with the engine at maximum continuous power, may not cause unacceptable mechanical damage or unacceptable power or thrust loss after the ingestion, or require the engine to be shut down. One-half the number of hailstones shall be aimed randomly over the inlet face area and the other half aimed at the critical inlet face area. The hailstones shall be ingested in a rapid sequence to simulate a hailstone encounter and the number and size of the hailstones shall be determined as follows:

(i) One 1-inch (25 millimeters) diameter hailstone for engines with inlet areas of not more than 100 square inches (0.0645 square meters).

(ii) One 1-inch (25 millimeters) diameter and one 2-inch (50 millimeters) diameter hailstone for each 150 square inches (0.0968 square meters) of inlet area, or fraction thereof, for engines with inlet areas of more than 100 square inches (0.0645 square meters).

(2) In addition to complying with paragraph (a)(1) of this section and except as provided in paragraph (b) of this section, it must be shown that each engine is capable of acceptable operation throughout its specified operating envelope when subjected to sudden encounters with the certification standard concentrations of rain and hail, as defined in appendix B to this part. Acceptable engine operation precludes flameout, run down, continued or non-recoverable surge or stall, or loss of acceleration and deceleration capability, during any three minute continuous period in rain and during any 30 second continuous period in hail. It must also be shown after the ingestion that there is no unacceptable mechanical damage, unacceptable power or thrust loss, or other adverse engine anomalies.

(b) Engines for rotorcraft. As an alternative to the requirements specified in paragraph (a)(2) of this section, for rotorcraft turbine engines only, it must be shown that each engine is capable of acceptable operation during and after the ingestion of rain with an overall ratio

of water droplet flow to airflow, by weight, with a uniform distribution at the inlet plane, of at least four percent. Acceptable engine operation precludes flameout, run down, continued or non-recoverable surge or stall, or loss of acceleration and deceleration capability. It must also be shown after the ingestion that there is no unacceptable mechanical damage, unacceptable power loss, or other adverse engine anomalies. The rain ingestion must occur under the following static ground level conditions:

(1) A normal stabilization period at take-off power without rain ingestion, followed immediately by the suddenly commencing ingestion of rain for three minutes at take-off power, then

(2) Continuation of the rain ingestion during subsequent rapid deceleration to minimum idle, then

(3) Continuation of the rain ingestion during three minutes at minimum idle power to be certified for flight operation, then

(4) Continuation of the rain ingestion during subsequent rapid acceleration to take-off power.

(c) Engines for supersonic aeroplanes. In addition to complying with paragraphs (a)(1) and (a)(2) of this section, a separate test for supersonic aeroplane engines only, shall be conducted with three hailstones ingested at supersonic cruise velocity. These hailstones shall be aimed at the engine's critical face area, and their ingestion must not cause unacceptable mechanical damage or unacceptable power or thrust loss after the ingestion or require the engine to be shut down. The size of these hailstones shall be determined from the linear variation in diameter from 1-inch (25 millimeters) at 35,000 feet (10,500 meters) to 1/4 - inch (6 millimeters) at 60,000 feet (18,000 meters) using the diameter corresponding to the lowest expected supersonic cruise altitude. Alternatively, three larger hailstones may be ingested at subsonic velocities such that the kinetic energy of these larger hailstones is equivalent to the applicable supersonic ingestion conditions.

(d) For an engine that incorporates or requires the use of a protection device, demonstration of the rain and hail ingestion capabilities of the engine, as required in paragraphs (a), (b), and (c) of this section, may be waived wholly or in part by the Minister if the applicant shows that:

(1) The subject rain and hail constituents are of a size that will not pass through the protection device;

(2) The protection device will withstand the impact of the subject rain and hail constituents; and

(3) The subject of rain and hail constituents, stopped by the protection device, will not obstruct the flow of induction air into the engine, resulting in damage, power or thrust loss, or other adverse engine anomalies in excess of what would be accepted in paragraphs (a),(b), and (c) of this section.

(Change 533-5)

533.79 *Fuel Burning Thrust Augmentor*

Each fuel burning thrust augmentor, including the nozzle, must:

(a) Provide cut-off of the fuel burning thrust augmentor;

(b) Permit on-off cycling;

(c) Be controllable within the intended range of operation;

(d) Upon a failure or malfunction of augmentor combustion, not cause the engine to lose thrust other than that provided by the augmentor; and

(e) Have controls that function compatibly with the other engine controls and automatically shut off augmentor fuel flow if the engine rotor speed drops below the minimum rotational speed at which the augmentor is intended to function.

SUBCHAPTER F
BLOCK TESTS TURBINE AIRCRAFT ENGINES

533.81 *Applicability*

This subchapter prescribes the block tests and inspections for turbine engines.

533.82 *General*

Before each endurance test required by this subchapter, the adjustment setting and functioning characteristic of each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must be established and recorded.

533.83 *Vibration Test*

(a) Each engine must undergo vibration surveys to establish that the vibration characteristics of those components that may be subject to mechanically or aerodynamically induced vibratory excitations are acceptable throughout the declared flight envelope. The engine surveys shall be based upon an appropriate combination of experience, analysis, and component test and shall address, as a minimum, blades, vanes, rotor discs, spacers, and rotor shafts.

(b) The surveys shall cover the ranges of power or thrust, and both the physical and corrected rotational speeds for each rotor system, corresponding to operations throughout the range of ambient conditions in the declared flight envelope, from the minimum rotational speed up to 103 percent of the maximum physical and corrected rotational speed permitted for rating periods of two minutes or longer, and up to 100 percent of all other permitted physical and corrected rotational speeds, including those that are overspeeds. If there is any indication of a stress peak arising at the highest of those required physical or corrected rotational speeds, the surveys shall be extended sufficiently to reveal the maximum stress values present, except that the extension need not cover more than a further 2 percentage points increase beyond those speeds.

(c) Evaluations shall be made of the following:

(1) The effects on vibration characteristics of operating with scheduled changes (including tolerances) to variable vane angles, compressor bleeds, accessory loading, the most adverse inlet air flow distortion pattern declared by the manufacturer, and the most adverse conditions in the exhaust duct(s); and

(2) The aerodynamic and aeromechanical factors which might induce or influence flutter in those systems susceptible to that form of vibration.

(d) Except as provided by paragraph (e) of this section, the vibration stresses associated with the vibration characteristics determined under this section, when combined with the appropriate steady stresses, must be less than the endurance limits of the materials concerned, after making due allowances for operating conditions for the permitted variations in properties of the materials. The suitability of these stress margins must be justified for each part evaluated. If it is determined that certain operating conditions, or ranges, need to be limited, operating and installation limitations shall be established.

(e) The effects on vibration characteristics of excitation forces caused by fault conditions (such as, but not limited to, out-of balance, local blockage or enlargement of stator vane passages, fuel nozzle blockage, incorrectly schedule compressor variables, etc.) shall be evaluated by test or analysis, or by reference to previous experience and shall be shown not to create a hazardous condition.

(f) Compliance with this section shall be substantiated for each specific installation configuration that can affect the vibration characteristics of the engine. If these vibration effects cannot be fully investigated during engine certification, the methods by which they can be evaluated and methods by which compliance can be shown shall be substantiated and defined in the installation instructions required by 533.5.

(Change 533-5)

533.84 *Engine Overtorque Test*
(amended 2010/05/27)

(a) If approval of a maximum engine overtorque is sought for an engine incorporating a free power turbine, compliance with this section must be demonstrated by testing.

(1) The test may be run as part of the endurance test requirement of section 533.87. Alternatively, tests may be performed on a complete engine or equivalent testing on individual groups of components.

(2) Upon conclusion of tests conducted to show compliance with this section, each engine part or individual groups of components must meet the requirements of paragraphs 533.93(a)(1) and (a)(2).

(b) The test conditions must be as follows:

(1) A total of 15 minutes run at the maximum engine overtorque to be approved. This may be done in separate runs, each being of at least 2.5 minutes duration.

(2) A power turbine rotational speed equal to the highest speed at which the maximum overtorque can occur in service. The test speed may not be more than the limit speed of take-off or OEI ratings longer than 2 minutes.

(3) For engines incorporating a reduction gearbox, a gearbox oil temperature equal to the maximum temperature when the maximum engine overtorque could occur in service; and for all other engines, an oil temperature within the normal operating range.

(4) A turbine entry gas temperature equal to the maximum steady state temperature approved for use during periods longer than 20 seconds when operating at conditions not associated with 30-second or 2 minutes OEI ratings. The requirement to run the test at the maximum approved steady state temperature may be waived by the Minister if the applicant can demonstrate that other testing provides substantiation of the temperature effects when considered in combination with the other parameters identified in paragraphs (b)(1), (b)(2) and (b)(3) of this section.

533.85 *Calibration Tests*

(a) Each engine must be subjected to those calibration tests necessary to establish its power characteristics and the conditions for the endurance test specified in 533.87. The results of the power characteristics of the engine over its entire operating range of speeds, pressures, temperatures, and altitudes. Power ratings are based upon standard atmospheric conditions with no airbleed for aircraft services and with only those accessories installed which are essential for engine functioning.

(b) A power check at sea level conditions must be accomplished on the endurance test engine after the endurance test and any change in power characteristics which occurs during the endurance test must be determined. Measurements taken during the final portion of the endurance test may be used in showing compliance with the requirements of this paragraph.

(c) In showing compliance with this section, each condition must stabilize before measurements are taken, except as permitted by paragraph (d) of this section.

(d) In the case of engines having 30-second OEI, and 2-minute OEI ratings, measurements taken during the applicable endurance test prescribed in 533.87(f) (1) through (8) may be used in showing compliance with the requirements of this section for these OEI ratings.

(Change 533-5)

533.87 *Endurance Test*

(a) General. Each engine must be subjected to an endurance test that includes a total of at least 150 hours of operation and, depending upon the type and contemplated use of the engine, consists of one of the series of runs specified in paragraphs (b) through (g) of this section, as applicable. For engines tested under paragraphs (b), (c), (d), (e) or (g) of this section, the prescribed 6-hour test sequence must be conducted 25 times to complete the required 150 hours of operation. Engines for which the 30-second OEI and 2-minute OEI ratings are desired must be further tested under paragraph (f) of this section. The following test requirements apply:

(1) The runs must be made in the order found appropriate by the Minister for the particular engine being tested.

(2) Any automatic engine control that is part of the engine must control the engine during the endurance test except for operations where automatic control is normally overridden by manual control or where manual control is otherwise specified for a particular test run.

(3) Except as provided in paragraph (a)(5) of this section, power or thrust, gas temperature, rotor shaft rotational speed, and, if limited, temperature of external surfaces of the engine must be at least 100 percent of the value associated with the particular engine operation being tested. More than one test may be run if all parameters cannot be held at the 100 percent level simultaneously.

(4) The runs must be made using fuel, lubricants and hydraulic fluid which conform to the specifications specified in complying with 533.7(c).

(5) Maximum air bleed for engine and aircraft services must be used during at least one-fifth of the runs, except for the test required under paragraph (f) of this section, provided the validity of the test is not compromised. However, for these runs, the power or thrust or the rotor shaft rotational speed may be less than 100 percent of the value associated with the particular operation being tested if the Minister finds that the validity of the endurance test is not compromised.
(amended 2010/01/29)

(6) Each accessory drive and mounting attachment must be loaded in accordance with paragraphs (a)(6)(i) and (ii) of this section, except as permitted by paragraph (a)(6)(iii) of this section for the test required under paragraph (f) of this section.
(amended 2010/01/29)

(i) The load imposed by each accessory used only for aircraft service must be the limit load specified by the applicant for the engine drive and attachment point during rated maximum continuous power or thrust and higher output.
(amended 2010/01/29)

(ii) The endurance test of any accessory drive and mounting attachment under load may be accomplished on a separate rig if the validity of the test is confirmed by an approved analysis.
(amended 2010/01/29)

(iii) The applicant is not required to load the accessory drives and mounting attachments when running the tests under paragraphs (f)(1) through (f)(8) of this section if the applicant can substantiate that there is no significant effect on the durability of any accessory drive or engine component. However, the applicant must add the equivalent engine output power extraction from the power turbine rotor assembly to the engine shaft output.
(amended 2010/01/29)

(7) During the runs at any rated power or thrust the gas temperature and the oil inlet temperature must be maintained at the limiting temperature except where the test periods are not longer than 5 minutes and do not allow stabilisation. At least one run must be made with fuel, oil, and hydraulic fluid at the minimum pressure limit and at least one run must be made with fuel, oil, and hydraulic fluid at the maximum pressure limit with fluid temperature reduced as necessary to allow maximum pressure to be attained.

(8) If the number of occurrences of either transient rotor shaft overspeed, transient gas overtemperature or transient engine overtorque is limited, that number of the accelerations required by paragraphs (b) through (g) of this section must be made at the limiting overspeed, overtemperature or overtorque. If the number of occurrences is not limited, half the required accelerations must be made at the limiting overspeed, overtemperature or

overtorque.
(amended 2010/05/27)

(9) For each engine type certificated for use on supersonic aircraft the following additional test requirements apply:

(i) To change the thrust setting, the power control level must be moved from the initial position to the final position in not more than one second except for movements into the fuel burning thrust augmentor augmentation position if additional time to confirm ignition is necessary.

(ii) During the runs at any rated augmented thrust the hydraulic fluid temperature must be maintained at the limiting temperature except where the test periods are not long enough to allow stabilisation.

(iii) During the simulated supersonic runs the fuel temperature and induction air temperature may not be less than the limiting temperature.

(iv) The endurance test must be conducted with the fuel burning thrust augmentor installed, with the primary and secondary exhaust nozzles installed, and with the variable area exhaust nozzles operated during each run according to the methods specified in complying with 533.5(b).

(v) During the runs at thrust settings for maximum continuous thrust and percentages thereof, the engine must be operated with the inlet air distortion at the limit for those thrust settings.

(b) Engines other than certain rotorcraft engines. For each engine, except a rotorcraft engine for which a rating is desired under paragraph (c), (d), or (e) of this section, the applicant must conduct the following runs:

(1) Take-off and idling. One hour of alternate 5-minute periods at rated take-off power and thrust and at idling power and thrust. The developed powers and thrusts at take-off and idling conditions and their corresponding rotor speed and gas temperature conditions must be as established by the power control in accordance with the schedule established by the manufacturer. The applicant may, during any one period, manually control the rotor speed, power, and thrust while taking data to check performance. For engines with augmented take-off power ratings that involve increase in turbine inlet temperature, rotor speed, or shaft power, this period of running at take-off must be at the augmented rating. For engines that do not materially increase operating severity, the amount of running conducted at the augmented rating is determined by the Minister. In changing the power setting after each period, the power-control lever must be moved in the manner prescribed in sub-paragraph (5) of this paragraph.

(2) Rated maximum continuous and take-off power and thrust. Thirty minutes at:

(i) Rated maximum continuous power and thrust during fifteen of the twenty-five 6-hour endurance test cycles; and

(ii) Rated take-off power and thrust during ten of the twenty-five 6-hour endurance test cycles.

(3) Rated maximum continuous power and thrust. One hour and 30 minutes at rated maximum continuous power and thrust.

(4) Incremental cruise power and thrust. Two hours and 30 minutes at the successive power lever positions corresponding to at least 15 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, the thrust and power may be varied in place of speed. If there is significant peak vibration anywhere between ground idle and maximum continuous conditions, the number of increments chosen may be changed to increase the amount of running made while subject to the peak vibrations up to not more than 50 percent of the total time spent in incremental running.

(5) Acceleration and deceleration runs. Thirty minutes of accelerations and decelerations, consisting of 6 cycles from idling power and thrust to rated take-off power and thrust and maintained at the take-off power lever position for 30 seconds and at the idling power lever position for approximately 4 1/2 minutes. In complying with this subparagraph, the power-control lever must be moved from one extreme position to the other in not more than 1 second, except that, if different regimes of control operations are incorporated necessitating scheduling of the power-control lever motion in going from one extreme position to the other, a longer period of time is acceptable, but not more than 2 seconds.

(6) Starts. One hundred starts must be made, of which 25 starts must be preceded by at least a 2-hour engine shutdown. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time, before attempting a normal start. There must be at least 10 normal restarts with not longer than 15 minutes since engine shutdown. The remaining starts may be made after completing the 150 hours of endurance testing.

(c) Rotorcraft engines for which a 30-minute OEI power rating is desired. For each rotorcraft engine for which a 30-minute OEI power rating is desired, the applicant must con duct the following series of tests:

(1) Take-off and idling. One hour of alternate 5-minute periods at rated take-off power and at idling power. The developed powers at take-off and idling conditions and their corresponding rotor speed and gas temperature conditions must be as established by the power control in accordance with the schedule established by the manufacturer. During any one period, the rotor speed and power may be controlled manually while taking data to check performance. For engines with augmented take-off power ratings that involve increases in turbine inlet temperature, rotor speed, or shaft power, this period of running at rated take-off power must be at the augmented power rating. In changing the power setting after each period, the power control lever must be moved in the manner prescribed in paragraph (c) (5) of this section.

(2) Rated maximum continuous and takeoff power. Thirty minutes at —
(amended 2010/01/29)

(i) Rated maximum continuous power during fifteen of the twenty-five 6-hour endurance test cycles; and
(amended 2010/01/29)

(ii) Rated take-off power during ten of the twenty-five 6-hour endurance test cycles. (amended 2010/01/29)

(3) Rated maximum continuous power. One hour at rated maximum continuous power. (amended 2010/01/29)

(4) Rated 30-minute OEI power. Thirty minutes at rated 30-minute OEI power. (amended 2010/01/29)

(5) Incremental cruise power. Two hours at the successive power lever positions corresponding with not less than 12 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, power may be varied in place of speed. If there are significant peak vibrations anywhere between ground idle and maximum continuous conditions, the number of increments chosen must be changed to increase the amount of running conducted while being subjected to the peak vibrations up to not more than 50 percent of the total time spent in incremental running.

(6) Acceleration and deceleration runs. Thirty minutes of accelerations and decelerations, consisting of six cycles from idling power to rated take-off power and maintained at the take-off power lever position for 30 seconds and at the idling power lever position for approximately 4 1/2 minutes. In complying with this paragraph, the power control lever must be moved from one extreme position to the other in not more than 1 second, however, different regimes of control operations are incorporated that necessitate scheduling of the power control lever motion in going from one extreme position to the other, then a longer period of time is acceptable, but not more than 2 seconds. (amended 2010/01/29)

(7) Starts. On hundred starts, of which 25 starts must be preceded by at least a 2-hour engine shut-down. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time, before attempting a normal start. There must be at least 10 normal restarts not more than 15 minutes after engine shutdown. The remaining starts may be made after completing the 150 hours of endurance testing.
(amended 2010/01/29)

(d) Rotorcraft engines for which a continuous OEI rating is desired. For each rotorcraft engine for which a continuous OEI power rating is desired, the applicant must conduct the following series of tests:

(1) Take-off and idling. One hour of alternate 5-minute periods at rated take-off power and at idling power. The developed powers at take-off and idling conditions and their corresponding rotor speed and gas temperature conditions must be as established by the power control in accordance with the schedule established by the manufacturer. During any one period the rotor speed and power may be controlled manually while taking data

to check performance. For engines with augmented take-off power ratings that involve increases in turbine inlet temperature, rotor speed, or shaft power, this period of running at rated take-off power must be at the augmented power rating. In changing the power setting after each period, the power control lever must be moved in the manner prescribed in paragraph (c)(5) of this section.

(2) Rated maximum continuous and take-off power. Thirty minutes at:

(i) Rated maximum continuous power during fifteen of the twenty-five 6-hour endurance test cycles; and

(ii) Rated take-off power during ten of the twenty-five 6-hour endurance test cycles.

(3) Rated continuous OEI power. One hour at rated continuous OEI power.

(4) Rated maximum continuous power. One hour at rated maximum continuous power.

(5) Incremental cruise power. Two hours at the successive power lever positions corresponding with not less than 12 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, power may be varied in place of speed. If there are significant peak vibrations anywhere between ground idle and maximum continuous conditions, the number of increments chosen must be changed to increase the amount of running conducted while being subjected to the peak vibrations up to not more than 50 percent of the total time spent in incremental running.

(6) Acceleration and deceleration runs. Thirty minutes of accelerations and decelerations, consisting of six cycles from idling power to rated take-off power and maintained at the take-off power lever position for 30 seconds and at the idling power lever position for approximately 4 1/2 minutes. In complying with this paragraph, the power control lever must be moved from one extreme position to the other in not more than 1 second, except that if different regimes of control operations are incorporated necessitating scheduling of the power control lever motion in going from one extreme position to the other, a longer period of time is acceptable, but not more than 2 seconds.

(7) Starts. One hundred starts, of which 25 starts must be preceded by at least a 2-hour engine shutdown. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time, before attempting a normal start. There must be at least 10 normal restarts with not longer than 15 minutes since engine shutdown. The remaining starts may be made after completing the 150 hours of endurance testing.

(e) Rotorcraft engines for which a 2 1/2 minute OEI power rating is desired. For each rotorcraft engine for which a 2 1/2 minute OEI power rating is desired, the applicant must conduct the following series of tests:

(1) Take-off, 2 1/2-minute OEI, and idling. One hour of alternate 5-minute periods at rated take-off power and at idling power except that, during the third and sixth take-off power periods, only 2 1/2 minutes need be conducted at rated take-off power, and the remaining 2 1/2 minutes must be conducted at rated 2 1/2-minute OEI power. The developed powers at take-off, 2 1/2-minute OEI, and idling conditions and their corresponding rotor speed and gas temperature conditions must be as established by the power control in accordance with the schedule established by the manufacturer. The applicant may, during any one period, control manually the rotor speed and power while taking data to check performance. For engines with augmented take-off power ratings that involve increases in turbine inlet temperature, rotor speed, or shaft power, this period of running at rated take-off power must be at the augmented rating. In changing the power setting after or during each period, the power control lever must be moved in the manner prescribed in paragraph (d)(6) of this section.

(2) The tests required in paragraphs (b)(2) through (b)(6), or (c)(2) through (c)(6), or (d)(2) through (d)(7) of this section, as applicable, except that in one of the 6-hour test sequences, the last 5 minutes of the 30 minutes at take-off power test period of paragraph (b)(2) of this section, or of the 30 minutes at 30-minute OEI power test period of paragraph (c)(2) of this section, or of the 1 hour at continuous OEI power test period of paragraph (d)(3) of this section, must be run at 2 1/2-minute OEI power.

(f) Rotorcraft engines for which 30-second OEI and 2-minute OEI ratings are desired. For each rotorcraft engine for which 30-second OEI and 2-minute OEI power ratings are desired, and following completion of the tests under paragraphs (b), (c), (d), or (e) of this section, the applicant may disassemble the tested engine to the extent necessary to show compliance with the requirements of 533.93(a). The tested engine must then be reassembled using the same parts used during the test runs of paragraphs (b), (c), (d), or (e) of this section, except those parts described as consumables in the Instructions for Continued Airworthiness. Additionally, the tests required in paragraphs (f)(1) through (f)(8) of this section must be run continuously. If a stop occurs during these tests, the interrupted sequence shall be repeated unless the applicant shows that the severity of the test would not be reduced if it were continued. The applicant must then conduct the following test sequence four times, for a total time of not less than 120 minutes:
(amended 2010/01/29)

(1) Take-off power. Three minutes at rated take-off power.

(2) 30-second OEI power. Thirty seconds at rated 30-second OEI power.

(3) 2-minute OEI power. Two minutes at rated 2-minute OEI power.

(4) 30-minute OEI power, continuous OEI power, or maximum continuous power. Five minutes at whichever is the greatest of rated 30-minute OEI power, rated continuous OEI power, or rated maximum continuous power, whichever is greatest, except that, during the first test sequence, this period shall be 65 minutes. However, where the greatest rated

power is 30-minute OEI power, that sixty-five minute period must consist of 30 minutes at 30-minute OEI power followed by 35 minutes at whichever is the greater of continuous OEI power or maximum continuous power.
(amended 2010/01/29)

(5) 50 percent take-off power. One minute at 50 percent take-off power.

(6) 30-second OEI power. Thirty seconds at rated 30-second OEI power.

(7) 2-minute OEI power. Two minutes at rated 2-minute OEI power.

(8) Idle. One minute at flight idle.
(amended 2010/01/29)

(g) Supersonic aircraft engines. For each engine type certificated for use on supersonic aircraft the applicant must conduct the following:

(1) Subsonic test under sea level ambient atmospheric conditions. Thirty runs of one hour each must be made, consisting of:

(i) Two periods of 5 minutes at rated take-off augmented thrust each followed by 5 minutes at idle thrust;

(ii) One period of 5 minutes at rated take-off thrust followed by 5 minutes at not more than 15 percent of rated take-off thrust;

(iii) One period of 10 minutes at rated take-off augmented thrust followed by 2 minutes at idle thrust, except that if rated maximum continuous augmented thrust is lower than rated take-off augmented thrust, 5 of the 10-minute periods must be at rated maximum continuous augmented thrust; and

(iv) Six periods of 1 minute at rated take-off augmented thrust each followed by 2 minutes, including acceleration and deceleration time, at idle thrust.

(2) Simulated supersonic test. Each run of the simulated supersonic test must be preceded by changing the inlet air temperature and pressure from that attained at subsonic condition to the temperature and pressure attained at supersonic velocity, and must be followed by a return to the temperature attained at subsonic condition. Thirty runs of 4 hours each must be made, consisting of:

(i) One period of 30 minutes at the thrust obtained with the power control lever set at the position for rated maximum continuous augmented thrust followed by 10 minutes at the thrust obtained with the power control lever set at the position for 90 percent of rated maximum continuous augmented thrust. The end of this period in the first five runs must be made with the induction air temperature at the limiting condition of transient overtemperature, but need not be repeated during the periods specified in paragraphs (g)(2) (ii) through (iv) of this section;

(ii) One period repeating the run specified in paragraph (g)(2)(i) of this section, except that it must be followed by 10 minutes at the thrust obtained with the power control lever set at the position for 80 percent of rated maximum continuous augmented thrust;

(iii) One period repeating the run specified in paragraph (g)(2)(i) of this section, except that it must be followed by 10 minutes at the thrust obtained with the power control lever set at the position for 60 percent of rated maximum continuous augmented thrust and then 10 minutes at not more than 15 percent of rated take-off thrust;

(iv) One period repeating the runs specified in paragraph (g)(2)(i) and (ii) of this section; and

(v) One period of 30 minutes with 25 of the runs made at the thrust obtained with the power control lever set at the position rated maximum continuous augmented thrust, each followed by idle thrust and with the remaining 5 runs at the thrust obtained with the power control lever set at the position for rated maximum continuous augmented thrust for 25 minutes each, followed by subsonic operation at not more than 15 percent of rated take-off thrust and accelerated to rated take-off thrust for 5 minutes using hot fuel.

(3) Starts. One hundred starts must be made, of which 25 starts must be preceded by an engine shutdown of at least 2 hours. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time before attempting a normal start. At least 10 starts must be normal restarts, each made no later than 15 minutes after engine shutdown. The starts may be made at any time, including the period of endurance testing.

(Change 533-1 (87-01-01))

(Change 533-2 (89-01-01))

(Change 533-5)

533.88 *Engine overtemperature test*

(a) Each engine must run for 5 minutes at maximum permissible r.p.m. with the gas temperature at least 75 (F (42 (C) higher than the maximum rating's steady-state operating limit, excluding maximum values of rpm and gas temperature associated with the 30-second OEI and 2- minute OEI ratings. Following this run, the turbine assembly must be within serviceable limits.

(b) In addition to the test requirements in paragraph (a) of this section, each engine for which 30-second OEI and 2-minute OEI ratings are desired, that incorporates a means for automatic temperature control within its operating limitations in accordance with 533.67(d), must run for a period of 4 minutes at the maximum power-on rpm with the gas temperature

at least 35°F (19°C) higher than the maximum operating limit at 30-second OEI rating. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Minister, to maintain the integrity of the turbine assembly.
(amended 2010/01/29)

(c) A separate test vehicle may be used for each test condition.
(amended 2010/01/29)

(Change 533-5)

533.89 *Operation Test*

(a) The operation test must include testing found necessary by the Minister to demonstrate:

(1) Starting, idling, acceleration, overspeeding, ignition, functioning of the propeller (if the engine is designated to operate with a propeller);

(2) Compliance with the engine response requirements of 533.73; and

(3) The minimum power or thrust response time to 95% rated take-off power or thrust, from power lever positions representative of minimum idle and of minimum flight idle, starting from stabilised idle operation, under the following engine load conditions:

(i) No bleed air and power extraction for aircraft use.

(ii) Maximum allowable bleed air and power extraction for aircraft use.

(iii) An intermediate value for bleed air and power extraction representative of that which might be used as a maximum for aircraft during approach to a landing.

(4) If testing facilities are not available, the determination of power extraction required in paragraphs (a)(3)(ii) and (iii) of this section may be accomplished through appropriate analytical means.

(b) The operation test must include all testing found necessary by the Minister to demonstrate that the engine has safe operating characteristics throughout its specified operating envelope.

533.90 *Initial Maintenance Inspection*

Each engine, except engines being type certificated through amendment of an existing type approval or through supplemental type certification procedures, must undergo an approved test run that simulates the conditions in which the engine is expected to operate in service, including start-stop cycles, to establish when the initial maintenance inspection is required. The test run must be accomplished on an engine which substantially conforms to the final type design.

533.91 *Engine System and Component Tests*
(amended 2010/01/29)

(a) For those systems or components that cannot be adequately substantiated in accordance with endurance testing of 533.87, the applicant must conduct additional tests to demonstrate that the systems or components are able to perform the intended functions in all declared environmental and operating conditions.
(amended 2010/01/29)

(b) Temperature limits must be established for those components that require temperature controlling provisions in the aircraft installation to assure satisfactory functioning, reliability, and durability.

(c) Each unpressurised hydraulic fluid tank must not fail or leak when subjected to maximum operating temperature and an internal pressure of 5 p.s.i., and each pressurised hydraulic fluid tank must meet the requirements of 533.64.
(amended 2010/01/29)

(d) For an engine type certificated for use in supersonic aircraft, the systems, safety devices, and external components that may fail because of operation at maximum and minimum operating temperatures must be identified and tested at maximum and minimum operating temperatures and while temperature and other operation conditions are cycled between maximum and minimum operating values.

533.92 *Rotor Locking Tests*

If continued rotation is prevented by a means to lock the rotor(s), the engine must be subjected to a test that includes 25 operations of this means under the following conditions:

(a) The engine must be shut down from rated maximum continuous thrust or power; and

(b) The means for stopping and locking the rotor(s) must be operated as specified in the engine operating instructions while being subjected to the maximum torque that could result from continued flight in this condition; and

(c) Following rotor locking, the rotor(s) must be held stationary under these conditions for five minutes for each of the 25 operations.

(Change 533-5)

533.93 *Teardown Inspection*

(a) After completing the endurance testing of 533.87 (b), (c), (d), (e), or (g) of this Chapter, each engine must be completely disassembled, and

(1) Each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must retain each setting and functioning characteristic within the limits that were established and recorded at the beginning of the test; and

(2) Each engine part must conform to the type design and be eligible for incorporation into an engine for continued operation, in accordance with information submitted in compliance with 533.4.

(b) After completing the endurance testing of 533.87(f), each engine must be completely disassembled, and

(1) Each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must retain each setting and functioning characteristic within the limits that were established and recorded at the beginning of the test; and

(2) Each engine may exhibit deterioration in excess of that permitted in paragraph (a)(2) of this section including some engine parts or components that may be unsuitable for further use. The applicant must show by inspection, analysis, test, or by any combination thereof as found necessary by the Minister, that structural integrity of the engine is maintained; or
(amended 2010/01/29)

(c) In lieu of compliance with paragraph (b) of this section, each engine for which the 30-second OEI and 2-minute OEI ratings are desired, may be subjected to the endurance testing of 533.87 (b), (c), (d), or (e) of this Chapter, and followed by the testing of 533.87(f) without intervening disassembly and inspection. However, the engine must comply with paragraph (a) of this section after completing the endurance testing of 533.87(f).

(Change 533-5)

533.94 *Blade containment and rotor unbalance tests*

(a) Except as provided in paragraph (b) of this section, it must be demonstrated by engine tests that the engine is capable of containing damage without catching fire and without failure of its mounting attachments when operated for at least 15 seconds, unless the resulting engine damage induces a self shutdown, after each of the following events:

(1) Failure of the most critical compressor or fan blade while operating at maximum permissible r.p.m. The blade failure must occur at the outermost retention groove or, for integrally-bladed rotor discs, at least 80 percent of the blade must fail.

(2) Failure of the most critical turbine blade while operating at maximum permissible r.p.m. The blade failure must occur at the outermost retention groove or, for integrally-bladed rotor discs, at least 80 percent of the blade must fail. The most critical turbine blade must be determined by considering turbine blade weight and strength of the adjacent turbine case at case temperatures and pressures associated with operation at maximum permissible r.p.m.

(b) Analysis based on rig testing component testing, or service experience may be substituted for one of the engine tests prescribed in paragraphs (a)(1) and (a)(2) of this section if:

(1) That test, of the two prescribed, produces the least rotor unbalance; and

(2) The analysis is shown to be equivalent to the test.

533.95 *Engine-Propeller Systems Tests*

If the engine is designed to operate with a propeller, the following tests must be made with a representative propeller installed by either including the tests in the endurance run or otherwise performing them in a manner acceptable to the Minister:

(a) Feathering operation: 25 cycles.

(b) Negative torque and thrust system operation: 25 cycles from rated maximum continuous power.

(c) Automatic decoupler operation: 25 cycles from rated maximum continuous power (if repeated decoupling and recoupling in service is the intended function of the device).

(d) Reverse thrust operation: 175 cycles from the flight-idle position to full reverse and 25 cycles at rated maximum continuous power from full forward to full reverse thrust. At the end of each cycle the propeller must be operated in reverse pitch for a period of 30 seconds at the maximum rotational speed and power specified by the applicant for reverse pitch operation.

533.96 *Engine tests in auxiliary power unit (APU) mode*

If the engine is designed with a propeller brake which will allow the propeller to be brought to a stop while the gas generator portion of the engine remains in operation, and remain stopped during operation of the engine as an auxiliary power unit ("APU mode"), in addition to the requirements of 533.87, the applicant must conduct the following tests:

(a) Ground locking: A total of 45 hours with propeller brake engaged in a manner which clearly demonstrates its ability to function without adverse effects on the complete engine while the engine is operating in the APU mode under the maximum conditions of engine speed, torque, temperature, air bleed, and power extraction as specified by the applicant.

(b) Dynamic braking: A total of 400 application-release cycles of brake engagements must be made in a manner which clearly demonstrates its ability to function without adverse effects on the complete engine under the maximum conditions of engine acceleration/deceleration rate, speed, torque and temperature as specified by the applicant. The propeller must be stopped prior to brake release.

(c) One hundred engine starts and stops with the propeller brake engaged.

(d) The tests required by paragraphs (a), (b) and (c) of this section must be performed on the same engine, but this engine need not be the same engine used for the tests required by 533.87.

(e) The tests required by paragraphs (a), (b) and (c) of this section must be followed by engine disassembly to the extent necessary to show compliance with the requirements of 533.93(a) and 533.93(b).

(Change 533-1 (87-01-01))

533.97 *Thrust Reversers*

(a) If the engine incorporates a reverser, the endurance, calibration, operation, and vibration tests prescribed in this subchapter must be run with the reverser installed. In complying with this section, the power control lever must be moved from one extreme position to the other in not more than 1 second except, if regimes of control operations are incorporated necessitating scheduling of the power control lever motion in going from one extreme position to the other, a longer period of time is acceptable but not more than 3 seconds. In addition, the test prescribed in paragraph (b) must be made. This test may be scheduled as part of the endurance run.

(b) One hundred seventy-five reversals must be made from flight-idle forward and 25 reversals must be made from rated take-off thrust to maximum reverse thrust. After each reversal the reverser must be operated at full reverse thrust for a period of 1 minute, except that, in the case of a reverser intended for use only as a braking means on the ground, the reverser need only be operated at full reverse thrust for 30-seconds.

533.99 *General Conduct of Block Tests*

(a) Each applicant may, in making a block test, use separate engines of identical design and construction in the vibration, calibration, endurance, and operation tests, except that, if a separate engine is used for the endurance test it must be subjected to a calibration check before starting the endurance test.

(b) Each applicant may service and make minor repairs to the engine during the block tests in accordance with the service and maintenance instructions submitted in compliance with 533.4. If the frequency of the service is excessive, or the number of stops due to engine malfunction is excessive, or a major repair, or replacement of a part is found necessary during the block tests or as the result of findings from the teardown inspection, the engine or its parts must be subjected to any additional tests the Minister finds necessary.

(c) Each applicant must furnish all testing facilities, including equipment and competent personnel, to conduct the block tests.

Appendix A
Instructions for Continued Airworthiness

A533.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by 533.4.

(b) The Instruction for Continued Airworthiness for each engine must include the Instructions for Continued Airworthiness for all engine parts. If Instructions for Continued Airworthiness are not supplied by the engine part manufacturer for an engine part, the Instructions for Continued Airworthiness for the engine must include the information essential to the continued airworthiness of the engine.

(c) The applicant must submit to the Minister a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of engine parts will be distributed.

A533.2 Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

A533.3 Content

The Instructions for Continued Airworthiness must contain the following manuals or sections, as appropriate, and information:

(a) Engine Maintenance Section.

(1) Introduction information that includes an explanation of the engine's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A detailed description of the engine and its components, systems and installations.

(3) Installation instructions, including proper procedures for uncrating, deinhibiting, acceptance checking, lifting and attaching accessories, with any necessary checks.

(4) Basic control and operating information describing how the engine components, systems, and installations operate, and information describing the methods of starting, running, testing and stopping the engine and its parts including any special procedures and limitations that apply.

(5) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, locations of lubrication points, lubricants to be used and equipment required for servicing.

(6) Scheduling information for each part of the engine that provides the recommended periods at which it should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialised maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross-references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the engine.

(7) Troubleshooting information describing probable malfunctions, how to recognise those malfunctions, and the remedial action for those malfunctions.

(8) Information describing the order and method of removing the engine and its parts and replacing parts, with any necessary precautions to be taken. Instructions for proper ground handling, crating and shipping must also be included.

(9) A list of the tools and equipment necessary for maintenance and directions as to their method of use.

(b) Engine Overhaul Section.

(1) Disassembly information including the order and method of disassembly for overhaul.

(2) Cleaning and inspection instructions that cover the materials and apparatus to be used and methods and precautions to be taken during overhaul. Methods of overhaul inspection must also be included.

(3) Details of all fits and clearances relevant to overhaul.

(4) Details of repair methods for worn or otherwise substandard parts and components along with the information necessary to determine when replacement is necessary.

(5) The order and method of assembly at overhaul.

(6) Instructions for testing after overhaul.

(7) Instructions for storage preparation including any storage limits.

(8) A list of tools needed for over-haul.

A533.4 Airworthiness Limitations Section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document.
(amended 2010/01/29)

(a) For all engines:
(amended 2010/01/29)

(1) The Airworthiness Limitations section must set forth each mandatory replacement time, inspection interval, and related procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual.
(amended 2010/01/29)

(2) This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations Section is approved by the Minister and specifies maintenance required by any applicable airworthiness or operational rule, unless an alternative program has been approved by the Minister."
(amended 2010/01/29)

(b) For rotorcraft engines having 30-second OEI and 2-minute OEI ratings:
(amended 2010/01/29)

(1) The Airworthiness Limitations section must also prescribe the mandatory post-flight inspections and maintenance actions associated with any use of either 30-second OEI or 2-minute OEI ratings.
(amended 2010/01/29)

(2) The applicant must validate the adequacy of the inspections and maintenance actions required under paragraph (b)(1) of A533.4.
(amended 2010/01/29)

(3) The applicant must establish an in-service engine evaluation program to ensure the continued adequacy of the instructions for mandatory post-flight inspections and maintenance actions prescribed under paragraph (b)(1) of A533.4 and of the data for 533.5(b)(4) pertaining to power availability. The program must include service engine tests or equivalent service engine test experience on engines of similar design and evaluations of service usage of the 30-second OEI or 2-minute OEI ratings.
(amended 2010/01/29)

***FAR**: The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document.*
(amended 2010/01/29)

(a) For all engines:
(amended 2010/01/29)

(1) The Airworthiness Limitations section must set forth each mandatory replacement time, inspection interval, and related procedure required of type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual.
(amended 2010/01/29)

(2) This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations Section is FAA approved and specifies maintenance required under 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved."
(amended 2010/01/29)

(Change 533-1 (87-01-01))

(Change 533-3 (91-11-01))

Appendix B
Certification Standard Atmospheric Concentrations of Rain and Hail

Figure B1, Table B1, Table B2, Table B3, and Table B4 specify the atmospheric concentrations and size distributions of rain and hail for establishing certification, in accordance with the requirements of Sec.533.78(a)(2). In conducting tests, normally by spraying liquid water to simulate rain conditions and by delivering hail fabricated from ice to simulate hail conditions, the use of water droplets and hail having shapes, sizes and distributions of sizes other than those defined in this appendix B, or the use of a single size or shape for each water droplet or hail, can be accepted, provided that applicant shows that the substitution does not reduce the severity of the test.

FIGURE B1 - Illustration of Rain and Hail Threats. Certification concentrations are obtained using Tables B1 and B2.

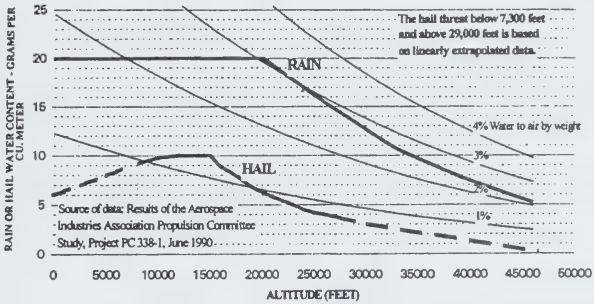


Table B1.--Certification Standard Atmospheric Rain Concentrations

Altitude (feet)	Rain Water Content (RWC) (grams water/ meter^3 air
0..	20.0
20,000..	20.0
26,300..	15.2
32,700..	10.8
39,300..	7.7
46,000..	5.2

RWC values at other altitudes may be determined by linear interpolation.

***Note**: Source of data--Results of the Aerospace Industries Association (AIA) Propulsion Committee Study, Project PC 338-1, June 1990.*

Table B2.--Certification Standard Atmospheric Hail Concentrations

Altitude (feet)	Hail Water Content (HWC) (grams water/ meter^3 air
0	6.0
7,300	8.9
8,500	9.4
10,000	9.9
12,000	10.0
15,000	10.0
16,000	8.9
17,700	7.8
19,300	6.6
21,500	5.6
24,300	4.4
29,000	3.3
46,000	0.2

HWC values at other altitudes may be determined by linear interpolation. The hail threat below 7,300 feet and above 29,000 feet is based on linearly extrapolated data.

***Note**: Source of data--Results of the Aerospace Industries Association (AIA Propulsion Committee (PC) Study, Project PC 338-1, June 1990.)*

Table B3.--Certification Standard Atmospheric Rain Droplet Size Distribution

Rain Droplet Diameter (mm)	Contribution Total RWC (%)
0-0.49	0
0.50-0.99	2.25
1.00-1.49	8.75
1.50-1.99	16.25
2.00-2.49	19.00
2.50-2.99	17.75
3.00-3.49	13.50
3.50-3.99	9.50
4.00-4.49	6.00
4.50-4.99	3.00
5.00-5.49	2.00
5.50-5.99	1.25
6.00-6.49	0.50
6.50-7.00	0.25
.......Total	100.00

Median diameter of rain droplets in 2.66 mm

***Note**: Source of data--Results of the Aerospace Industries Association (AIA Propulsion Committee (PC) Study, Project PC 338-1, June 1990.)*

Table B4.--Certification Standard Atmospheric Hail Size Distribution

Hail Diameter (mm)	Contribution Total HWC (%)
0-4.9	0
5.0-9.9	17.00
10.0-14.9	25.00
15.0-19.9	22.50
20.0-24.9	16.00
25.0-29.9	9.75
30.0-34.9	4.75
35.0-39.9	2.50
40.0-44.9	1.50
45.0-49.9	0.75
50.0-55.0	0.25
Total	100.00

Median diameter of hail is 16 mm

***Note**: Source of data--Results of the Aerospace Industries Association (AIA Propulsion Committee (PC) Study, Project PC 338-1, June 1990.)*

(Change 533-5)

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 535 - AIRCRAFT PROPELLERS

Canada

Available through your local book seller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Fax: (613) 954-5779 or 1-800-661-2868
Orders only: 1-800-635-7943
Internet: http://publications.communication.gc.ca

Catalogue No.: T51-15/535-2010E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2010-1 (2010/06/01)	2012/03/06	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL
CHAPTER 535 - PROPELLERS

Table Of Contents

Preamble

General

The content of this chapter is based on the *United States Code of Federal Regulations*, Title 14, Chapter I, Part 35 entitled Airworthiness Standards, Propellers. These United States airworthiness standards have been used and adapted as the model for the Canadian standards supplemented by additional airworthiness requirements based on Canadian experience and required for Canadian aviation purposes.

The FAR numbering system is used. The Canadian standards bears the same number as the FAR equivalent, prefixed by the number "5", as this chapter contains the standards for Part V of the *Canadian Aviation Regulations* (CARs).

First Edition — Effective: January 1, 1986

The first edition of this chapter is based on FAR Part 35, up to and including amendment 35-5 published in the Federal Register dated September 11, 1980. Except for administrative changes (e.g., Administrator = Minister; Part = Chapter) and the deletion of references to operating FARs, there are no Canadian variations included in this first edition.

The standards in this chapter are presented in a two column format with the United States FAR in the left column and the Canadian standards in the right column. Chapters, subchapters, sections and subsections numbering and headings are opposite to the equivalent FAR. Where the Canadian standard is identical to the FAR, the words "No Variation" appear; where a variation exists, the affected part of text is printed opposite to the FAR with all changes underlined.

Change 535-1 — Effective: August 1, 1991

This change incorporates Amendment 35-6 to the United States Code of Federal Regulations, Title 14, Chapter I, Part 35 published in the Federal Register dated August 18, 1989. This amendment changes a cross reference to Part 91 in Appendix A of Part 35 and as such it is not applicable in Canada. This FAR change is part of a larger reorganization of the general U.S. operating and flight rules to make them more understandable and easier to use.

In addition, section 535.1 has been rewritten to refer to the Air Regulation enabling the type certificate of aeronautical products.

Information Notes:

1. The Enabling authority has been replaced by the reference to the Canadian Aviation Regulations *in section 535.1.*

2. Changes are identified by [ ] brackets. Editorial changes are not identified.

Second Edition **Published with Amendment 2000-2**
Change 535-2 **dated June 1, 2000**

This amendment introduces a new format such as the removal of the left-hand column containing the FARs. The Canadian standards in this chapter are now presented in a full-page format. The amendment number and date of affected pages has been removed from the bottom of the page. Instead, affected sections will be followed by amendment numbers and dates of current changes as well as any previous changes.

The content of this chapter has in no way been changed and future changes will continue to be identified by [ ] brackets.

Change 535-3 **Published: December 30, 2006**

Correction to french version **Effective: May 20, 2005**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ **2005-010**	▪ 535.1

This amendment entitled "Applicability" provides a correction to section 1 of the French version. Whereas Airworthiness Manual Chapter 535 sets out the airworthiness standards for propellers, the French version makes an erroneous reference to *ballons libres habités* (manned free balloons), which is now corrected to read *hélices* (propellers).

Change 535-4 **Published: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the Canadian Aviation Regulations (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends section 535.1 to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

Change 535-5 **Published: June 1, 2010**

This Change incorporates the following amendments to the United States Code of Federal Regulations, Title 14, Chapter I, Part 35:

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
▪ 2009-016	• 535.1 • 535.2 • 535.3 • 535.5 • 535.7 • 535.11 • 535.13 • 535.15 • 535.17 • 535.21 • 535.22 • 535.23 • 535.24 • 535.31 • 535.33 • 535.34 • 535.35 • 535.36 • 535.37 • 535.38 • 535.39 • 535.40 • 535.41 • 535.42 • 535.43 • 535.45 • 535.47

This amendment entitled "Airworthiness Standards; Propellers" addresses technological advances of the past twenty years and is harmonized with the Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) propeller certification requirements, thereby simplifying airworthiness approvals for imports and exports.

AIRWORTHINESS MANUAL
CHAPTER 535 - PROPELLERS

SUBCHAPTER A
GENERAL

535.1 Applicability

(a) This Chapter sets out airworthiness standards for the issue of type certificates and changes to type certificates, for propellers.

(b) Reserved.
(amended 2009/12/01)

(c) An applicant is eligible for a propeller type certificate and changes to those certificates after demonstrating compliance with subchapters A, B and C of this chapter. However, the propeller may not be installed on an aeroplane unless the applicant has shown compliance with either 523.907 or 525.907 of this Manual, as applicable or compliance is not required for installation on that aeroplane.
(amended 2010/01/29)

(d) For the purposes of this chapter, the propeller consists of those components listed in the propeller type design and the propeller system consists of the propeller and all the components necessary for its functioning, but not necessarily included in the propeller type design.
(amended 2010/01/29)

(Change 535-1 (91-08-01))

535.2 *Propeller Configuration*
(amended 2010/01/29)

The applicant must provide a list of all the components, including references to the relevant drawings and software design data that define the type design of the propeller to be approved under Part V of the *Canadian Aviation Regulations* relating to Approval of the Type Design of an Aeronautical Product.
(amended 2010/01/29)

535.3 Instructions for Propeller Installation and Operation
(amended 2010/01/29)

The applicant must provide instructions that are approved by the Minister. Those approved instructions must contain:
(amended 2010/01/29)

(a) Instructions for installing and operating the propeller., which:
(amended 2010/01/29)

(1) Include a description of the operational modes of the propeller control system and functional interface of the control system with the aeroplane and engine systems;
(amended 2010/01/29)

(2) Specify the physical and functional interfaces with the aeroplane, aeroplane equipment and engine;
(amended 2010/01/29)

(3) Define the limiting conditions on the interfaces from paragraph (a)(2) of this section;
(amended 2010/01/29)

(4) List the limitations established under 535.5;
(amended 2010/01/29)

(5) Define the hydraulic fluids approved for use with the propeller, including grade and specification, related operating pressure and filtration levels; and
(amended 2010/01/29)

(6) State the assumptions made to comply with the requirements of this chapter.
(amended 2010/01/29)

(b) Instructions for operating the propeller which must specify all procedures necessary for operating the propeller within the limitations of the propeller type design.
(amended 2010/01/29)

535.4 Instructions for Continued Airworthiness

The applicant must prepare Instructions for Continued Airworthiness in accordance with Appendix A to this Chapter that are acceptable to the Minister. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first aircraft with the propeller installed, or upon issuance of a standard certificate of airworthiness for an aircraft with the propeller installed, whichever occurs later.

535.5 Propeller Ratings and Operating Limitations
(amended 2010/01/29)

(a) Propeller ratings and operating limitations must:
(amended 2010/01/29)

(1) Be established by the applicant and approved by the Minister,
(amended 2010/01/29)

(2) Be included directly or by reference in the propeller type certificate data sheet, as specified in Part V of the *Canadian Aviation Regulations* relating to Approval of the Type

Design of an Aeronautical Product,
(amended 2010/01/29)

(3) Be based on the operating conditions demonstrated during the tests required by this Chapter as well as any other information the Minister requires as necessary for the safe operation of the propeller.
(amended 2010/01/29)

(b) Propeller ratings and operating limitations must be established for the following, as applicable:
(amended 2010/01/29)

(i) Power and rotational speed:(i) For takeoff;
(amended 2010/01/29)

(ii) For maximum continuous;
(amended 2010/01/29)

(iii) If requested by the applicant, other ratings may also be established.
(amended 2010/01/29)

(2) Overspeed and overtorque limits.
(amended 2010/01/29)

535.7 *Features and Characteristics*
(amended 2010/01/29)

(a) The propeller must not have features or characteristics, revealed by any test or analysis or known to the applicant that make it unsafe for the uses for which certification is requested.
(amended 2010/01/29)

(b) If a failure occurs during a certification test, the applicant must determine the cause and assess the effect on the airworthiness of the propeller. The applicant must make changes to the design and conduct additional tests that the Minister finds necessary to establish the airworthiness of the propeller.
(amended 2010/01/29)

SUBCHAPTER B
DESIGN AND CONSTRUCTION

535.11 Reserved
(amended 2010/01/29)

535.13 Reserved
(amended 2010/01/29)

535.15 Safety Analysis
(amended 2010/01/29)

(a)
(amended 2010/01/29)

(1) The applicant must analyze the propeller system to assess the likely consequences of all failures that can reasonably be expected to occur. This analysis will take into account, if applicable:
(amended 2010/01/29)

(i) The propeller system in a typical installation. When the analysis depends on representative components, assumed interfaces, or assumed installed conditions, the assumptions must be stated in the analysis;
(amended 2010/01/29)

(ii) Consequential secondary failures and dormant failures;
(amended 2010/01/29)

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous propeller effects defined in paragraph (g)(1) of this section.
(amended 2010/01/29)

(2) The applicant must summarize those failures that could result in major propeller effects or hazardous propeller effects defined in paragraph (g) of this section, and estimate the probability of occurrence of those effects.
(amended 2010/01/29)

(3) The applicant must show that hazardous propeller effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability of 10-7 or less per propeller flight hour). Since the estimated probability for individual failures may be insufficiently precise to enable the applicant to assess the total rate for hazardous propeller effects, compliance may be shown by demonstrating that the probability of a hazardous propeller effect arising from an individual failure can be predicted to be not greater than 10-8 per propeller flight hour. In dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgment and previous

experience combined with sound design and test philosophies.
(amended 2010/01/29)

(b) If significant doubt exists as to the effects of failures or likely combination of failures, the Minister may require assumptions used in the analysis to be verified by test.
(amended 2010/01/29)

(c) The primary failures of certain single elements (for example, blades) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous propeller effects, then compliance may be shown by reliance on the prescribed integrity requirements of this chapter. These instances must be stated in the safety analysis.
(amended 2010/01/29)

(d) If reliance is placed on a safety system to prevent a failure progressing to hazardous propeller effects, the possibility of a safety system failure in combination with a basic propeller failure must be included in the analysis. Such a safety system may include safety devices, instrumentation, early warning devices, maintenance checks and other similar equipment or procedures. If items of the safety system are outside the control of the propeller manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts must be clearly stated in the analysis and identified in the propeller installation and operation instructions required under 535.3.
(amended 2010/01/29)

(e) If the safety analysis depends on one or more of the following items, those items must be identified in the analysis and appropriately substantiated.
(amended 2010/01/29)

(1) Maintenance actions being carried out at stated intervals. This includes verifying that items that could fail in a latent manner are functioning properly. When necessary to prevent hazardous propeller effects, these maintenance actions and intervals shall be published in the instructions for continued airworthiness required under 535.4. Additionally, if errors in maintenance of the propeller system could lead to hazardous propeller effects, the appropriate maintenance procedures shall be included in the relevant propeller manuals.
(amended 2010/01/29)

(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual.
(amended 2010/01/29)

(3) The provision of specific instrumentation not otherwise required. Such instrumentation must be published in the appropriate documentation.
(amended 2010/01/29)

(4) A fatigue assessment.
(amended 2010/01/29)

(f) If applicable, the safety analysis must include, but not be limited to, assessment of indicating equipment, manual and automatic controls, governors and propeller control systems, synchrophasers, synchronizers and propeller thrust reversal systems.
(amended 2010/01/29)

(g) Unless otherwise approved by the Minister and stated in the safety analysis, the following failure definitions apply to compliance with this part.
(amended 2010/01/29)

(1) The following are regarded as hazardous propeller effects:
(amended 2010/01/29)

(i) The development of excessive drag;
(amended 2010/01/29)

(ii) A significant thrust in the opposite direction to that commanded by the pilot;
(amended 2010/01/29)

(iii) The release of the propeller or any major portion of the propeller;
(amended 2010/01/29)

(iv) A failure that results in excessive unbalance.
(amended 2010/01/29)

(2) The following are regarded as major propeller effects for variable pitch propellers:
(amended 2010/01/29)

(i) An inability to feather the propeller for feathering propellers.
(amended 2010/01/29)

(ii) An inability to change propeller pitch when commanded.
(amended 2010/01/29)

(iii) A significant uncommanded change in pitch.
(amended 2010/01/29)

(iv) A significant uncontrollable torque or speed fluctuation.
(amended 2010/01/29)

535.17 Materials and Manufacturing Methods
(amended 2010/01/29)

(a) The suitability and durability of materials used in the propeller must:
(amended 2010/01/29)

(1) Be established on the basis of experience, tests or both;

(2) Account for environmental conditions expected in service.

(b) All materials and manufacturing methods must conform to specifications acceptable to the Minister.
(amended 2010/01/29)

(c) The design values of properties of materials must be suitably related to the most adverse properties stated in the material specification for applicable conditions expected in service.
(amended 2010/01/29)

535.19 Durability

Each part of the propeller must be designed and constructed to minimise the development of any unsafe condition of the propeller between overhaul periods.

535.21 Variable and Reversible Pitch Propellers
(amended 2010/01/29)

(a) No single failure or malfunction in the propeller system will result in unintended travel of the propeller blades to a position below the in-flight low-pitch position. The extent of any intended travel below the in-flight low-pitch position must be documented by the applicant in the appropriate manuals. Failure of structural elements need not be considered if the occurrence of such a failure is shown to be extremely remote under 535.15.
(amended 2010/01/29)

(b) For propellers incorporating a method to select blade pitch below the in-flight low pitch position, provisions must be made to sense and indicate to the flight crew that the propeller blades are below that position by an amount defined in the installation manual. The method for sensing and indicating the propeller blade pitch position shall be such that its failure does not affect the control of the propeller.
(amended 2010/01/29)

535.22 Feathering Propellers
(amended 2010/01/29)

(a) Feathering propellers are intended to feather from all flight conditions, taking into account expected wear and leakage. Any feathering and unfeathering limitations must be documented in the appropriate manuals.
(amended 2010/01/29)

(b) Propeller pitch control systems that use engine oil to feather must incorporate a method to allow the propeller to feather if the engine oil system fails.
(amended 2010/01/29)

(c) Feathering propellers must be designed to be capable of unfeathering after the propeller system has stabilized to the minimum declared outside air temperature.
(amended 2010/01/29)

535.23 Propeller Control System
(amended 2010/01/29)

The requirements of this section apply to any system or component that controls, limits or monitors propeller functions.
(amended 2010/01/29)

(a) The propeller control system must be designed, constructed and validated to show that:
(amended 2010/01/29)

(1) The propeller control system, operating in normal and alternative operating modes and in transition between operating modes, performs the functions defined by the applicant throughout the declared operating conditions and flight envelope;
(amended 2010/01/29)

(2) The propeller control system functionality is not adversely affected by the declared environmental conditions, including temperature, electromagnetic interference (EMI), high intensity radiated fields (HIRF) and lightning. The environmental limits to which the system has been satisfactorily validated must be documented in the appropriate propeller manuals;
(amended 2010/01/29)

(3) A method is provided to indicate that an operating mode change has occurred if flight crew action is required. In such an event, operating instructions must be provided in the appropriate manuals.
(amended 2010/01/29)

(b) The propeller control system must be designed and constructed so that, in addition to compliance with 535.15:
(amended 2010/01/29)

(1) No single failure or malfunction of electrical or electronic components in the control system results in a hazardous propeller effect.
(amended 2010/01/29)

(2) Failures or malfunctions directly affecting the propeller control system in a typical aeroplane, such as structural failures of attachments to the control, fire or overheat do not lead to a hazardous propeller effect.
(amended 2010/01/29)

(3) The loss of normal propeller pitch control does not cause a hazardous propeller effect under the intended operating conditions.
(amended 2010/01/29)

(4) The failure or corruption of data or signals shared across propellers does not cause a hazardous propeller effect.
(amended 2010/01/29)

(c) Electronic propeller control system imbedded software must be designed and implemented by a method approved by the Minister that is consistent with the criticality of the performed functions and that minimizes the existence of software errors.
(amended 2010/01/29)

(d) The propeller control system must be designed and constructed so that the failure or corruption of aeroplane-supplied data does not result in hazardous propeller effects.
(amended 2010/01/29)

(e) The propeller control system must be designed and constructed so that the loss, interruption or abnormal characteristic of aeroplane-supplied electrical power does not result in hazardous propeller effects. The power quality requirements must be described in the appropriate manuals.
(amended 2010/01/29)

(Change 535-1 (91-08-01))

535.24 Strength
(amended 2010/01/29)

The maximum stresses developed in the propeller may not exceed values acceptable to the Minister considering the particular form of construction and the most severe operating conditions.
(amended 2010/01/29)

SUBCHAPTER C
TESTS AND INSPECTIONS

535.31 Reserved
(amended 2010/01/29)

This subchapter prescribes the tests and inspections for propellers and their essential accessories.

535.33 General

(a) Each applicant shall furnish test article(s) and suitable testing facilities, including equipment, and competent personnel, and conduct the required tests in accordance with Part V of the *Canadian Aviation Regulations* relating to Approval of the Type Design of an Aeronautical Product.
(amended 2010/01/29)

(b) All automatic controls and safety systems must be in operation unless it is accepted by the Minister as impossible or not required because of the nature of the test. If needed for substantiation, the applicant may test a different propeller configuration if this does not

constitute a less severe test.
(amended 2010/01/29)

(c) Any systems or components that cannot be adequately substantiated by the applicant to the requirements of this part are required to undergo additional tests or analysis to demonstrate that the systems or components are able to perform their intended functions in all declared environmental and operating conditions.
(amended 2010/01/29)

535.34 Inspections, Adjustments and Repairs
(amended 2010/01/29)

(a) Before and after conducting the tests prescribed in this chapter, the test article must be subjected to an inspection and a record must be made of all the relevant parameters, calibrations and settings.
(amended 2010/01/29)

(b) During all tests, only servicing and minor repairs are permitted. If major repairs or part replacement is required, the Minister must approve the repair or part replacement prior to implementation and may require additional testing. Any unscheduled repair or action on the test article must be recorded and reported.
(amended 2010/01/29)

535.35 Centrifugal Load Tests
(amended 2010/01/29)

The applicant must demonstrate that a propeller complies with paragraphs (a), (b) and (c) of this section without evidence of failure, malfunction or permanent deformation that would result in a major or hazardous propeller effect. When the propeller could be sensitive to environmental degradation in service, this must be considered. This section does not apply to fixed-pitch wood or fixed- pitch metal propellers of conventional design.
(amended 2010/01/29)

(a) The hub, blade retention system and countertweights must be tested for a period of one hour to a load equivalent to twice the maximum centrifugal load to which the propeller would be subjected during operations at the maximum rated rotational speed.
(amended 2010/01/29)

(b) Blade features associated with transitions to the retention system (for example, a composite blade bonded to a metallic retention) must be tested either during the test of paragraph (a) of this section or in a separate component test for a period of one hour to a load equivalent to twice the maximum centrifugal load to which the propeller would be subjected during operation at the maximum rated rotational speed.
(amended 2010/01/29)

(c) Components used with or attached to the propeller (for example, spinners, de-icing equipment and blade erosion shields) must be subjected to a load equivalent to 159 percent of the maximum centrifugal load to which the component would be subjected during operation at the maximum rated rotational speed. This must be performed by either:
(amended 2010/01/29)

(1) Testing at the required load for a period of 30 minutes; or
(amended 2010/01/29)

(2) Analysis based on test.
(amended 2010/01/29)

535.36 Bird Impact
(amended 2010/01/29)

The applicant must demonstrate, by tests or analysis based on tests or experience on similar designs that the propeller can withstand the impact of a 4-pound bird at the critical location(s) and critical flight condition(s) of a typical installation without causing a major or hazardous propeller effect. This section does not apply to fixed-pitch wood propellers of conventional design.
(amended 2010/01/29)

535.37 Fatigue Limits and Evaluation
(amended 2010/01/29)

This section does not apply to fixed-pitch wood propellers of conventional design.
(amended 2010/01/29)

(a) Fatigue limits must be established by tests or analysis based on tests for propeller:
(amended 2010/01/29)

(1) Hubs;
(amended 2010/01/29)

(2) Blades;
(amended 2010/01/29)

(3) Blade retention components.
(amended 2010/01/29)

(4) Components which are affected by fatigue loads and which are shown under 535.15 to have a fatigue failure mode leading to hazardous propeller effects.
(amended 2010/01/29)

(b) The fatigue limits must take into account:
(amended 2010/01/29)

(1) All known and reasonably foreseeable vibration and cyclic load patterns. that are expected in service; and
(amended 2010/01/29)

(2) Expected service deterioration, variations in material properties, manufacturing variations and environmental effects.
(amended 2010/01/29)

(c) A fatigue evaluation of the propeller must be conducted to show that hazardous propeller effects due to fatigue will be avoided throughout the intended operational life of the propeller on either:
(amended 2010/01/29)

(1) The intended aeroplane by complying with 523.907 or 525.907 of this Manual, as applicable; or
(amended 2010/01/29)

(2) A typical aeroplane.
(amended 2010/01/29)

535.38 Lightning Strike
(amended 2010/01/29)

The applicant must demonstrate, by tests, analysis based on tests or experience on similar designs that the propeller can withstand a lightning strike without causing a major or hazardous propeller effect. The limit to which the propeller has been qualified must be documented in the appropriate manuals. This section does not apply to fixed-pitch wood propellers of conventional design.
(amended 2010/01/29)

535.39 Endurance Test

Endurance tests on the propeller system must be made on a representative engine in accordance with paragraph (a) or (b) of this section, as applicable, without evidence of failure or malfunction.
(amended 2010/01/29)

(a) Fixed-pitch and ground adjustable-pitch propellers must be subjected to one of the following tests:
(amended 2010/01/29)

(1) A 50-hour flight test in level flight or in climb. The propeller must be operated at take-off power and rated rotational speed during at least five hours of this flight test and not less than 90 percent of the rated rotational speed for the remainder of the 50 hours.
(amended 2010/01/29)

(2) A 50-hour ground test at take-off power and rated rotational speed
(amended 2010/01/29)

(b) Variable-pitch propellers must be subjected to one of the following tests:
(amended 2010/01/29)

(1) A 100-hour endurance test that must include the following conditions:
(amended 2010/01/29)

(i) Five hours at take-off power and rotational speed and thirty 10-minute cycles composed of:
(amended 2010/01/29)

(A) Acceleration from idle;
(amended 2010/01/29)

(B) Five minutes at take-off power and rotational speed;
(amended 2010/01/29)

(C) Deceleration; and
(amended 2010/01/29)

(D) Five minutes at idle.
(amended 2010/01/29)

(ii) Fifty hours at maximum continuous power and rotational speed;
(amended 2010/01/29)

(iii) Fifty hours, consisting of ten 5-hour cycles composed of:
(amended 2010/01/29)

(A) Five accelerations and decelerations between idle and take-off power and rotational speed;
(amended 2010/01/29)

(B) Four and one half hours at approximately even incremental conditions from idle up to, but not including maximum continuous power and rotational speed; and
(amended 2010/01/29)

(C) Thirty minutes at idle.
(amended 2010/01/29)

(2) Operation of the propeller throughout the engine endurance tests prescribed in Chapter 533 of this Manual.

(c) An analysis based on tests of propellers of similar design may be used in place of the tests of paragraphs (a) and (b) of this section.
(amended 2010/01/29)

535.40 Functional Test

The variable-pitch propeller system must be subjected to the applicable functional tests of this section. The same propeller system used in the endurance test of 535.39 must be used in the functional tests and must be driven by a representative engine on a test stand or on an aeroplane. The propeller must complete these tests without evidence of failure or malfunction. This test may be combined with the endurance test for accumulation of cycles.
(amended 2010/01/29)

(a) Manually-controllable propellers. Five hundred representative flight cycles must be made across the range of pitch and rotational speed.
(amended 2010/01/29)

(b) Governing propellers. Fifteen hundred complete cycles must be made across the range of pitch and rotational speed.
(amended 2010/01/29)

(c) Feathering propellers. Fifty cycles of feather and unfeather operation must be made.

(d) Reversible-pitch propellers. Two hundred complete cycles of control must be made from lowest normal pitch to maximum reverse pitch. During each cycle, the propeller must run for 30 seconds at the maximum power and rotational speed selected by the applicant for maximum reverse pitch.
(amended 2010/01/29)

(e) An analysis based on tests of propellers of similar design may be used in place of the tests of this section.
(amended 2010/01/29)

535.41 Overspeed and Overtorque

(amended 2010/01/29)

(a) When the applicant seeks approval of a transient maximum propeller overspeed, the applicant must demonstrate that the propeller is capable of further operation without maintenance action at the maximum propeller overspeed condition. This may be accomplished by:
(amended 2010/01/29)

(1) Performance of 20 runs, each of 30 seconds duration, at the maximum propeller overspeed condition; or
(amended 2010/01/29)

(2) Analysis based on test or service experience.
(amended 2010/01/29)

(b) When the applicant seeks approval of a transient maximum propeller overtorque, the applicant must demonstrate that the propeller is capable of further operation without

maintenance action at the maximum propeller overtorque condition. This may be accomplished by:
(amended 2010/01/29)

(1) Performance of 20 runs, each of 30 seconds duration, at the maximum propeller overtorque condition; or
(amended 2010/01/29)

(2) Analysis based on test or service experience.
(amended 2010/01/29)

535.42 Components of the Propeller Control System
(amended 2010/01/29)

The applicant must demonstrate by tests, analysis based on tests or service experience on similar components that each propeller blade pitch control system component, including governors, pitch change assemblies, pitch locks, mechanical stops, and feathering system components can withstand cyclic operation that simulates the normal load and pitch change travel to which the component would be subjected during the initially declared overhaul period or during a minimum of 1,000 hours of typical operation in service.
(amended 2010/01/29)

535.43 Propeller Hydraulic Components
(amended 2010/01/29)

Applicants must show by test, validated analysis or both that propeller components that contain hydraulic pressure and whose structural failure or leakage from a structural failure could cause a hazardous propeller effect demonstrate structural integrity by:
(amended 2010/01/29)

(a) A proof pressure test to 1.5 times the maximum operating pressure for one minute without permanent deformation or leakage that would prevent performance of the intended function.
(amended 2010/01/29)

(b) A burst pressure test to 2.0 times the maximum operating pressure for one minute without failure. Leakage is permitted and seals may be excluded from the test.
(amended 2010/01/29)

535.45 Reserved
(amended 2010/01/29)

535.47 Reserved
(amended 2010/01/29)

APPENDIX A
INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

A535.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by 535.4.

(b) The Instructions for Continued Airworthiness for each propeller must include the Instructions for Continued Airworthiness for all propeller parts. If Instructions for Continued Airworthiness are not supplied by the propeller part manufacturer for a propeller part, the Instructions for Continued Airworthiness for the propeller must include the information essential to the continued airworthiness of the propeller.

(c) The applicant must submit to the Minister a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of propeller parts will be distributed.

A535.2 Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

A535.3 Content

The Instructions for Continued Airworthiness must contain the following sections and information:

(a) Propeller Maintenance Section.

(1) Introduction information that includes an explanation of the propeller's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A detailed description of the propeller and its systems and installations.

(3) Basic control and operating information describing how the propeller components and systems are controlled and how they operate, including any special procedures that apply.

(4) Instructions for uncrating, acceptance checking, lifting, and installing the propeller.

(5) Instructions for propeller operational checks.

(6) Scheduling information for each part of the propeller that provides the recommended periods at which it should be cleaned, adjusted, and tested, the applicable wear tolerances, and the degree of work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if it shows that the item has an exceptionally high degree of complexity requiring specialized

maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross-references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the propeller.

(7) Troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions.

(8) Information describing the order and method of removing and replacing propeller parts with any necessary precautions to be taken.

(9) A list of the special tools needed for maintenance other than for overhauls.

(b) Propeller Overhaul Section.

(1) Disassembly information including the order and method of disassembly for overhaul.

(2) Cleaning and inspection instructions that cover the materials and apparatus to be used and methods and precautions to be taken during overhaul. Methods of overhaul inspection must also be included.

(3) Details all fits and clearances relevant to overhaul.

(4) Details of repair methods for worn or otherwise substandard parts and components along with information necessary to determine when replacement is necessary.

(5) The order and method of assembly at overhaul.

(6) Instructions for testing after overhaul.

(7) Instructions for storage preparation including any storage limits.

(8) A list of tools needed for overhaul.

A535.4 Airworthiness Limitations Section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, inspection interval, and related procedure required for type certification. This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations section is approved by the Minister and specifies maintenance required by any applicable airworthiness or operational rule, unless an alternative program has been approved by the Minister".

Transport Canada   Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 537 - APPLIANCES

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa (Ontario)
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51-15/537-2010E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2010-2 (2010/05/31)	2010/05/26	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL CHAPTER 537 - APPLIANCES AND PARTS

Table of Contents

Interpretation Provision for Part V Standards

In these Standards:

(a) The passages giving the Minister the power to determine, approve, establish or authorise something without stating the criteria for the use of such power are to be construed as requiring that the power be used in consideration of two factors: the airworthiness of the appliance or part that is the subject of the determination, approval or authorisation, or of the aircraft on which the appliance or part that is the subject of the determination, approval or authorisation is to be installed, and the aircraft's level of safety;

(b) the word "approved" or "authorised", when used without an indication of a method of approval or authorisation, is to be construed as referring to an approval or an authorisation granted under the *Aeronautics Act*.

Procurement of Reference Publications

Federal Aviation Administration (FAA) Technical Standard Orders (TSO) referenced in this Chapter of the *Airworthiness Manual* are available in English only and may be consulted free at:

Transport Canada
Aircraft Certification Technical Reference Centre
Place de Ville, Tower C,
330 Sparks Street, Room 465
Ottawa, Ontario
K1A 0N5

or:

by Internet at:

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgTSO.nsf/MainFrame?OpenFrameSet

Preamble

First Edition **Effective: June 1, 1987**

The content of this Chapter is based on the Aviation Technical Standard Orders referenced in FAA Advisory Circular No. 20-110C, Appendix 1, the "Index of Aviation Technical Standards Orders", dated May 13, 1986, published by the Federal Aviation Administration (U.S.); and on standards previously published in the *Engineering and Inspection Manual, Part II.*

Change 537-1 **Effective: March 1, 1989**

This change contains:

(a) A revised list of Aviation Technical Standard Orders in Subchapter B, based on Advisory Circular AC 20- 110D, Appendix 1, dated June 12, 1987; and

(b) One additional standard, "Helicopter Passenger Transportation Suit System", added to Subchapter C.

Changes are identified by brackets; editorial alterations and typographical corrections will not be identified.

The content of this change has been subjected to consultation with the aviation industry and has received general acceptance.

Change 537-2 **Effective: February 3, 1992**

This change contains:

(a) A revised list of Aviation Technical Standard Orders in Subchapter B based on Advisory Circular, AC 20-110G, Appendix 1, dated June 19, 1991; and

(b) An amendment to Section 537.203 addressing Child Restraint Systems Standards with the following changes:

(1) A revised definition of "Child Restraint System",

(2) Added the standards of Chapter 921 of the *Hazardous Products Act* pertaining to child restraint systems manufactured after January 1, 1981.

(3) Amended the FMVSS No. 213 Standards which have been adopted with some limitations in Canada.

(4) Adopted CMVSS No. 213 as Canadian Aviation Standard.

Change 537-3 **Effective: December 30, 1993**

This change contains:

(a) A revised list of Aviation Technical Standard Orders in Subchapter B, based on Advisory Circular AC 20-110H, Appendix 1, dated May 6, 1993.

(b) A modification of paragraph 537.7 that specifies the identification requirements for appliances as contained in the *Air Regulations* Series II, No.1, section 14; and

(c) A relocation of paragraph 537.9 of the Procurement of Reference Publications to page iv.

Change 537-4 **Effective: 29 October 1998**

This change contains:

(a) A revised list of Aviation Technical Standard Orders in Subchapter B, based on Advisory Circular AC 20-110J, Appendix 1, dated May 30, 1997, including TSO-C149 and TSO-C150 published by FAA after May 30, 1997 . This change was subjected to consultation with the aviation industry through NPA 1998-174, dated 19 August 1998, and has received general acceptance;

(b) Cross reference criteria between FAR and Canadian regulations, that were previously contained in AMA 537/1, and the AMA has been canceled. This change was subjected to consultation with the aviation industry through NPA 1994-16, dated 20 December 1994, and has received general acceptance; and

(c) The addition of an Information Note after paragraph 537.205 (c).

Information Note:

Effective 1 December 1998 a new Chapter 551 of the Airworthiness Manual, entitled "Aircraft Equipment and Installation Standards" has been published. This chapter contains the acceptable design standards as well as installation standards for use by installers and users of these items of equipment.

Chapter 537 " Appliances" of this manual remains valid; it specifies the current standards for issuance of a Type Certificate for new aviation appliances and is designer / manufacturer oriented.

Change 537-5 **Published: December 1, 2003**

1. **General**

This change introduces a new amendment format. This new amendment format is introduced in Chapter 537 of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following changes to the amendment procedures are introduced in this Change 537-5:

- the preamble will become the focal point regarding the sections affected by this Change. The change number will no longer be provided at the end of an amended section. Rather, for the current change only, an amendment tag identifying the "coming into force date" of the provision will follow the amended text. (example: (amended 2003/06/01)).
- brackets "[ ]" will no longer be used to identify new or revised text. In the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted but followed by an electronic link to the previous version of the modified text. (example: (amended 2003/06/01; previous version)).
- the preamble will include a table of change information. This table will include the Notices of Proposed Amendments (NPAs) with the corresponding amended sections.

2. Simplified Process for the Amendment of the Design Standards of Airworthiness by Adopting by Reference a Foreign Amendment

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2001-250 (Effective: 1 October 2001) • 2002-028 (Effective: 15 April 2002)	• 537.103

These proposed amendments adopt by reference recently amended and published Federal Aviation Administration (FAA) Technical Standard Orders (TSO) to harmonize section 537.103 with the FAA's list of TSOs.

3. CARAC Proposed Amendment Recommendations

This change implements the following amendments to the standard recommended by the CARAC Technical Committee Part V- Aircraft Certification

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 1998-284	• 537.207

With the publication of the *Canadian Aviation Regulations* (CARs) in 1996 and the revocation of the *Engineering and Inspection Manual* (E&I Manual), some information contained in Part II, Chapter III, section 3.12 of the E&I Manual regarding emergency locator transmitters (ELT), especially ELT batteries, would be lost. The CARAC Equipment Standards - Airworthiness Manual 551/537 Working Group studied the above problem and recommended that a new section be added to Chapter 537 of the *Airworthiness Manual* to capture information that will be left out as a result of the revocation of the E&I Manual.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2001-018	• 537.205

The CARAC Technical Committee Part V - Aircraft Certification, 551/537 Working Group recommended in its final report that the revised CGSB standards for helicopter passenger transportation suit systems be reviewed for adoption when it comes into effect. The revision to this CGSB standard is an attempt to harmonize the CAN/CGSB 65.16 standard for marine abandonment immersion suit systems so as to achieve possible dual role certification. The Aircraft Certification Branch of Transport Canada was involved in the development of this revision to the CGSB standards.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2000-110	• 537.103

This proposed amendment adopts the FAA TSO for Terrain Awareness Warning System (TAWS) harmonizes section 537.103 with the FAA's list of TSOs.

Change 537-6 **Published: December 1, 2005**

1. Simplified Process for the Amendment of the Design Standards of Airworthiness by Adopting by Reference a Foreign Amendment

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2003-134 (Effective: July 9, 2003)	• 537.103

This amendment updates the list of Transport Canada approved TSOs from the FAA list of recently amended and published Technical Standard Orders (TSO). The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's list of TSOs.

2. CARAC Proposed Amendment Recommendations

This change implements the following amendments to the standard recommended by the CARAC Technical Committee Part V:

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2004-037	• 537.201 • 537.205 • 537.207

This amendment deletes the requirements for aircraft passenger transportation suit systems and emergency locator transmitters. These requirements are deleted from Chapter 537 in order to transfer these requirements into the more appropriate location of Chapter 551.

Change 537-7 **Published: December 30, 2006**

This change contains the following:

Technical Standard Orders **Effective: June 8, 2004**

Table of Change Information	
Notice of Proposed Amendment	**Amended Section**
• 2005-011	• 537.103

This amendment updates the list of Transport Canada approved TSOs from the FAA list of recently amended and published Technical Standard Orders (TSO). The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's list of TSOs.

Change 537-8 **Published: June 30, 2007**

This change contains the following:

Technical Standard Orders **Effective: March 8, 2007**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
• 2006-004	• 537.103	TSO-C1d	TSO-C1c
		TSO-C26d	TSO-C26c
		TSO-C39c	TSO-C39b
		TSO-C54c	TSO-C54b
		TSO-C132	
		TSO-C155	
		TSO-C157	
		TSO-C158	
		TSO-C159	
		TSO-C163	
		TSO-C164	
		TSO-C165	
		TSO-C166	
		TSO-C167	
		TSO-C169	
		TSO-C170	
		TSO-C171	
		TSO-C173	

This amendment updates the list of Transport Canada adopted Technical Standard Orders (TSOs) with those recently amended and published TSOs identified from the FAA list of current TSOs, as modified between 30 September 2003 and 2 May 2005. The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's current list of TSOs.

Technical Standard Orders **Effective: March 8, 2007**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
• 2006-009	• 537.103	TSO-C59a	TSO-C59
		TSO-C122a	TSO-C122
		TSO-C128a	TSO-C128
		TSO-C139	-
		TSO-C154a	TSO-C154
		TSO-C174	-

This amendment updates the list of Transport Canada adopted Technical Standard Orders (TSOs) with those recently amended and published TSOs identified from the FAA list of current TSOs, as modified between 3 May 2005 and 26 August 2005. The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's current list of TSOs.

Change 537-9 **Published: December 30, 2007**

This change contains the following:

Technical Standard Orders **Effective: July 16, 2007**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
• 2007-019	• 537.103		TSO-C31d
			TSO-C32d
			TSO-C37d
			TSO-C38d
		TSO-C16a	TSO-C16
			TSO-C16 A-1
		TSO-C44c	TSO-C44b
		TSO-C45b	TSO-C45a
			TSO-C50c
		TSO-C56b	TSO-C56a
			TSO-C57a
			TSO-C58a
		TSO-C62e	TSO-C62d
		TSO-C121a	TSO-C121
		TSO-C123b	TSO-C123a

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
		TSO-C142a	TSO-C142
		TSO-C175	
		TSO-C176	
		TSO-C177	
		TSO-C178	
		TSO-C179	

This amendment updates the list of Transport Canada adopted Technical Standard Orders (TSOs) with those recently amended and published TSOs identified from the FAA list of current TSOs, as modified between 17 May 2004 and 22 August 2006.

TSO-C31d and TSO-C32d are deleted from AWM 537.103 because TSO-170 High Frequency (HF) Radio Communications Transceiver Equipment Operating Within the Radio Frequency combines the requirements of the cancelled TSO-C31d, High Frequency Radio Communications Transmitting Equipment Operating Within the Radio Frequency Range of 1.5 to 30 Megahertz and TSO-C32d, High Frequency Radio Communications Receiving Equipment Operating Within the Radio Frequency Range of 1.5 to 30 Megahertz.

TSO-C37d and TSO-C38d are deleted from the AWM 537.103 because TSO-169 VHF Radio Communications Transceiver Equipment Operating Within the Radio Frequency Range 117.975 combines the requirements of TSO-C37d, VHF Radio Communications Transmitting Equipment Operating within the Radio Frequency Range 117.975 - 136.000 Megahertz and TSO-C38d, VHF Radio Communications Receiving Equipment Operating within the Radio Frequency Range 117.975 - 136.000 Megahertz, as well as updates the requirements to include 8.33 Kilohertz (kHz) channel spacing capability.

TSO-C50c, TSO-C57a and TSO-C58a are deleted from the AWM 537.103 because TSO-C139 Aircraft Audio Systems and Equipment affects new applications submitted after its effective date. The FAA cancelled TSO-C50c, Audio Selector Panels and Amplifiers, TSO-C57a, Headsets and Speakers, and TSO-C58a, Aircraft Microphones, after publishing TSO-C139.

Change 537-10 **Published: December 30, 2008**

This change contains the following:

Technical Standard Orders **Effective: October 30, 2008**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
• 2007-029	• 537.103	TSO-C5f	TSO-C5e
		TSO-C8e	TSO-C8d
		TSO-C76a	TSO-C76
		TSO-C88b	TSO-C88a
		TSO-C124b	TSO-C124a
		TSO-C144a	TSO-C144
		TSO-C145b	TSO-C145a
		TSO-C146b	TSO-C146a
		TSO-C154b	TSO-C154a
		TSO-C166a	TSO-C166
		TSO-C190	

This amendment updates the list of Transport Canada adopted Technical Standard Orders (TSOs) with those recently amended and published TSOs identified from the FAA list of current TSOs, as modified between 23 August 2006 and 17 April 2007. The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's current list of TSOs.

Change 537-11 **Published: June 30, 2009**

This change contains the following:

Technical Standard Orders **Effective: May 11, 2009**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled TSO**
• 2009-006	• 537.103	TSO-C3e	TSO-C3d
		TSO-C6e	TSO-C6d
		TSO-C22g with note	-
		TSO-C47a	TSO-C47
		TSO-C55a	TSO-C55
		TSO-C64b	TSO-C64a
		TSO-C78a	TSO-C78
		TSO-C74d	TSO-C74c
		TSO-C85b	TSO-C85a
		TSO-C89a	TSO-C89
		-	TSO-C94a
		TSO-C95a	TSO-C95
		TSO-C99a	TSO-C99
		TSO-C112c	TSO-C112b
		-	TSO-C120
		TSO-C126a	TSO-C126
		TSO-C137a	TSO-C137
		TSO-C145c	TSO-C145b
		TSO-C146c	TSO-C146b
		TSO-C160	-
		TSO-C163a	TSO-C163
		TSO-C169a	TSO-C169

This amendment updates the list of Transport Canada adopted Technical Standard Orders (TSOs) with those recently amended and published TSOs identified from the FAA list of current TSOs, as modified between May 17, 2007 and February 6, 2009. The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's current list of TSOs.

Change 537-12 **Published: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the *Canadian Aviation Regulations* (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends Chapter 537 of the AWM to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521.

Subchapter A is amended to refer to the new Canadian Technical Standard Order (CAN-TSO) design approval and to make related changes.

The general provisions of Subchapter B have been modified to reflect our new CAN-TSO and to add a new column to the table to provide the CAN-TSO number that corresponds to the adopted FAA TSO.

Subchapter C is amended to delete section 537.203 on child restraint systems, which is now part of Chapter 551 of the AWM.

Change 537-13 **Published: December 1, 2010**

This change contains the following:

Technical Standard Orders **Effective: May 27, 2010**

Table of Change Information			
Notice of Proposed Amendment	**Amended Section**	**New/Revised TSO**	**Cancelled CAN-TSO**
• 2009-122	• 537.103	CAN-TSO-C19c	CAN-TSO-C19b
		CAN-TSO-C48a	CAN-TSO-C48
		CAN-TSO-C116a	CAN-TSO-C116
		CAN-TSO-C119c	CAN-TSO-C119b
		CAN-TSO-C135a	CAN-TSO-C135
		CAN-TSO-C154c	CAN-TSO-C154b
		CAN-TSO-C161a	CAN-TSO-C161
		CAN-TSO-C162a	CAN-TSO-C162
		CAN-TSO-C166b	CAN-TSO-C166a
		CAN-TSO-C196	

This amendment updates the list of Transport Canada adopted Canadian Technical Standard Orders (CAN-TSOs) with those recently amended and published CAN-TSOs identified from the FAA list of current TSOs, as modified between February 7, 2009 and December 17, 2009. The adoption of these FAA TSOs harmonizes section 537.103 with the FAA's current list of TSOs.

In addition, editorial revisions to the section and paragraph numbering of 537.101 and 537.103 are made to restore the location of adopted FAA TSOs to section 537.103. Continued use of section 537.103 to identify those adopted FAA TSOs will simplify and therefore better enable ongoing determination of historical and current effective dates of FAA TSOs in Canada, through the use of the CARAC Notice of Proposed Amendments System database search function, allowing the use of the single search criteria of "537.103" to obtain an appropriate listing.

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 537 - APPLIANCES AND PARTS

(amended 2009/12/01)

SUBCHAPTER A GENERAL

537.1 *Applicability*

(a) Pursuant to section 521.106 of the *Canadian Aviation Regulations*, this Chapter sets out the standards of airworthiness for appliances and parts.
(amended 2009/12/01)

(b) For each appliance or part to which these standards apply, "standard of airworthiness" means, for the design, manufacture or maintenance of that appliance or part, the description, in terms of a minimum standard, of the properties and attributes of the configuration, material, performance or physical characteristics of that appliance or part and includes the procedures to ascertain compliance with or to maintain that minimum standard.
(amended 2009/12/01)

(Change 537-1 (89-03-01))
(Change 537-2 (92-02-03))
(Change 537-4 (98-10-29))

537.3 *Cross Reference*

(a) Where a reference is made in an adopted FAA Technical Standard Order, set out in Sub-chapter B, to Federal Aviation Regulations (FAR) or Title 14 of the Code of Federal Regulations (14 CFR), the following text must be substituted respectively:
(amended 2009/12/01)

(i) Parts 23, 25, 27, 29, 31, 33 and 35, as the Chapters 523, 525, 527, 529, 531, 533 and 535 of the *Airworthiness Manual*.
(amended 2009/12/01)

(ii) Procedures, of FAR Part 21, and data requirements, such as FAR 37.5 or FAR 21.605 as Part V, Subpart 21 of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

(iii) Marking requirements, such as FAR 37.7, FAR 21.607 or 14 CFR Part 45 as Part II, Subpart I of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

(b) Unless stated otherwise in this Chapter, internationally recognized standards referenced in a Canadian Technical Standard Order are also incorporated by reference as part of the Canadian Technical Standard Order.
(amended 2009/12/01)

(Change 537-1 (89-03-01))
(Change 537-2 (92-02-03))
(Change 537-4 (98-10-29))

537.5 *Canadian Technical Standard Order (CAN-TSO) Design Approval*

(amended 2009/12/01)

The requirements for the issuance of a Canadian Technical Standard Order (CAN-TSO) design approval for an appliance or part are contained in Part V, Subpart 21 of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

(Change 537-1 (89-03-01))
(Change 537-2 (92-02-03))
(Change 537-4 (98-10-29))

537.7 *Identification*

The identification requirements for an appliance or part are prescribed in Part II, Subpart I of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

(Change 537-1 (89-03-01))
(Change 537-2 (92-02-03))
(Change 537-3 (93-12-30))
(Change 537-4 (98-10-29))

SUBCHAPTER B
CANADIAN TECHNICAL STANDARD ORDERS

(amended 2009/12/01)

537.101 *General*

This subchapter contains a list of the Canadian Technical Standard Orders (CAN-TSOs) that are the standards of airworthiness for the issuance of a change to a Canadian Technical Standard Order (CAN-TSO) design approval in respect of an appliance or a part.
(amended 2010/05/27)

537.103 *Adopted Technical Standard Orders*
(amended 2010/05/27)

The Canadian Technical Standard Orders (CAN-TSOs) consist of those FAA Technical Standard Orders that are adopted by the Minister using the simplified process for the amendment of the design standards of airworthiness, as set out in the CARAC Charter, and are identified with a corresponding CAN-TSO number in the following table.
(amended 2010/05/27)

(Change 537-1 (89-03-01))
(Change 537-2 (92-02-03))
(Change 537-3 (93-12-30))
(Change 537-4 (98-10-29))

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C1d	Cargo Compartment Fire Detection Instruments (08/19/04) (amended 2007/03/08)	TSO-C1d (amended 2007/03/08)
CAN-TSO-C2d	Airspeed Instruments (6/14/89)	TSO-C2d
CAN-TSO-C3e	Turn-and-slip Instrument (10/15/07) (amended 2009/05/11)	TSO-C3e
CAN-TSO-C4c	Bank and Pitch Instruments (Indicating -stabilized Type) (Gyroscopic Horizon, Attitude Gyro) (07/15/58)	TSO-C4c
CAN-TSO-C5f	Direction Instrument, Non-magnetic (Gyroscopically Stabilized) (02/02/2007) (amended 2008/10/30)	TSO-C5f
CAN-TSO-C6e	Direction Instrument, Magnetic (Gyroscopically-Stabilized) (04/24/08) (amended 2009/05/11)	TSO-C6e

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C7d	Direction Instrument, Magnetic Non-stabilized Type (Magnetic Compass) (6/14/89)	TSO-C7d
CAN-TSO-C8e	Vertical Velocity Instrument (Rate-of-Climb) (04/17/2007) (amended 2008/10/30)	TSO-C8e
CAN-TSO-C9c	Automatic Pilots (02/01/59)	TSO-C9c
CAN-TSO-C10b	Aircraft Altimeter, Pressure Actuated Sensitive Type (02/01/59)	TSO-C10b
CAN-TSO-C11e	Power Plant Fire Detection Instruments (Thermal and Flame Contact Types) (10/17/91)	TSO-C11e
CAN-TSO-C13f	Life Preservers (09/24/92)	TSO-C13f
CAN-TSO-C14b	Aircraft Fabric, Intermediate Grade; (02/15/90)	TSO-C14b
CAN-TSO-C15d	Aircraft Fabric, Grade A; (02/26/90)	TSO-C15d
CAN-TSO-C16a	Electrically Heated Pitot and Pitot Static Tubes (10/06/2006) (amended 2007/07/16)	TSO-C16a (amended 2007/07/16)
CAN-TSO-C19c (amended 2010/05/27)	Portable Water-Solution Type Fire Extinguishers (02/26/2009) (amended 2010/05/27)	TSO-C19c (amended 2010/05/27)
CAN-TSO-C20	Combustion Heaters (02/01/49)	TSO-C20
CAN-TSO-C20 A-1	Amendment-1, Combustion Heaters (4/16/51) (amended 2002/04/15)	TSO-C20 A-1 (amended 2002/04/15)
CAN-TSO-C21b	Aircraft Turnbuckle Assemblies and/or Turnbuckle Safety Devices (03/16/89)	TSO-C21b
CAN-TSO-C22g	Safety Belts (03/05/93) ***Information Note**: By notice of change to TSO C-22g published in the Federal Register, Vol. 58, No. 169, page 4557 September 2, 1993, the following sentence in the applicability paragraph was deleted: "Safety belts approved prior to the date of this TSO may continue to be manufactured for an additional six months at which time they may no longer be manufactured under the provisions of their original approval." Whereas Transport Canada recognizes TSOs for their airworthiness standards only and not as rules of conduct, the U.S. manufacturing*	TSO-C22g

CAN-TSO Number	Subject	FAA TSO Number
	requirement originally incorporated into this TSO had no effect on Transport Canada manufacturing approvals. The change is noted here for information purposes. (amended 2009/05/11)	
CAN-TSO-C23d	Personnel Parachute Assemblies (06/01/94)	TSO-C23d
CAN-TSO-C25a	Aircraft Seats and Berths (Type I Transport, 6g Forward Load) (01/01/56)	TSO-C25a
CAN-TSO-C26d	Aircraft Wheels, Brakes and Wheel-Brake Assemblies for Parts 23, 27 and 29 Aircraft (10/14/04) (amended 2007/03/08)	TSO-C26d (amended 2007/03/08)
CAN-TSO-C27	Twin Seaplane Floats (06/01/51)	TSO-C27
CAN-TSO-C27 A-2	Amendment-2, Twin Seaplane Floats (6/30/55) (amended 2002/04/15)	TSO-C27 A-2 (amended 2002/04/15)
CAN-TSO-C28	Aircraft Skis (12/15/51)	TSO-C28
CAN-TSO-C30c	Aircraft Position Lights (05/12/89)	TSO-C30c
CAN-TSO-C34e	ILS Glide Slope Receiving Equipment Operating within 328.6 - 335.4 Megahertz (01/15/88)	TSO-C34e
CAN-TSO-C35d	Airborne Radio Marker Receiving Equipment (04/15/71)	TSO-C35d
CAN-TSO-C36e	Airborne ILS Localizer Receiving Equipment operating within the Radio Frequency Range of 108 to 112 Megahertz (01/25/88)	TSO-C36e
CAN-TSO-C39c	9g Transport Airplane Seats Certified by Static Testing (02/13/04) (amended 2007/03/08)	TSO-C39c (amended 2007/03/08)
CAN-TSO-C40c	VOR Radio Receiving Equipment Operating within the Radio Frequency Range of 108-117.95Megahertz (01/25/88)	TSO-C40c
CAN-TSO-C41d	Airborne Automatic Direction Finding (ADF) Equipment (05/06/85)	TSO-C41d
CAN-TSO-C42	Propeller Feathering Hose Assemblies (Rubber and Wire Braid Construction) (01/06/56)	TSO-C42
CAN-TSO-C43c	Temperature Instruments (05/30/95)	TSO-C43c

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C44c	Fuel Flowmeters (08/22/2006) (amended 2007/07/16)	TSO-C44c (amended 2007/07/16)
CAN-TSO-C45b	Manifold Pressure Instruments (08/22/2006) (amended 2007/07/16)	TSO-C45b (amended 2007/07/16)
CAN-TSO-C46a	Maximum Allowable Airspeed Indicator Systems (05/04/68)	TSO-C46a
CAN-TSO-C47a	Fuel, Oil, and Hydraulic Pressure Instruments (08/08/06) (amended 2009/05/11)	TSO-C47a
CAN-TSO-C48a (amended 2010/05/27)	Carbon Monoxide Detector Instruments (05/06/2009) (amended 2010/05/27)	TSO-C48a (amended 2010/05/27)
CAN-TSO-C49b	Electric Tachometer: Magnetic Drag (Indicator and Generator) (05/30/95)	TSO-C49b
CAN-TSO-C52b	Flight Director Equipment (05/30/95)	TSO-C52b
CAN-TSO-C53a	Fuel and Engine Oil System Hose Assemblies (Rubber or Tetrafluoroethylene Tube and Wire Braid Construction (05/08/59)	TSO-C53a
CAN-TSO-C54c	Stall Warning System (04/21/05) (amended 2007/03/08)	TSO-C54c (amended 2007/03/08)
CAN-TSO-C55a	Fuel and Oil Quantity Instruments (06/08/07) (amended 2009/05/11)	TSO-C55a
CAN-TSO-C56b	Engine Driven Direct Current Generator/Starter Generators (06/01/06) (amended 2007/07/16)	TSO-C56b (amended 2007/07/16)
CAN-TSO-C59a	Airborne Selective Calling (SELCAL) Equipment (07/14/05) (amended 2007/03/08)	TSO-C59a (amended 2007/03/08)
CAN-TSO-C60b	Airborne Area Navigation Equipment Using Loran C Inputs05/11/88)	TSO-C60b
CAN-TSO-C62e (amended 2007/07/16)	Aircraft Tires (09/29/2006) (amended 2007/07/16)	TSO-C62e (amended 2007/07/16)
CAN-TSO-C63c	Airborne Weather and Ground Mapping Pulsed Radars (08/18/83)	TSO-C63c
CAN-TSO-C64b	Passenger Oxygen Mask Assembly, Continuous Flow (05/21/08) (amended 2009/05/11)	TSO-C64b

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C65a	Airborne Doppler Radar Ground Speed and/or Drift Angle Measuring Equipment (for Air Carrier Aircraft) (08/18/83)	TSO-C65a
CAN-TSO-C66c	Distance Measuring Equipment (DME) Operating within the Radio Frequency Range of 960-1215 Megahertz (01/18/91)	TSO-C66c
CAN-TSO-C67	Airborne Radar Altimeter Equipment (for Air Carrier Aircraft) (04/12/60)	TSO-C67
CAN-TSO-C68a	Airborne Automatic Dead Reckoning Computer Equipment Utilizing Aircraft Heading and Doppler Ground Speed and Drift Angle Data (for Air Carrier Aircraft) (08/18/83)	TSO-C68a
CAN-TSO-C69c (amended 2001/10/01)	Emergency Evacuation Slides, Ramps, Ramp/Slides, and Slide/Rafts (8/18/99) (amended 2001/10/01)	TSO-C69c (amended 2001/10/01)
CAN-TSO-C70a	Liferafts (Reversible and Non-reversible) (04/13/84)	TSO-C70a
CAN-TSO-C71	Airborne Static ("DC to DC") Electrical Power Converter (for Air Carrier Aircraft) (04/15/61)	TSO-C71
CAN-TSO-C72c	Individual Flotation Devices (02/19/87)	TSO-C72c
CAN-TSO-C73	Static Electrical Power Inverter (07/25/63)	TSO-C73
CAN-TSO-C74d	Air Traffic Control Radar Beacon System (ATCRBS) Airborne Equipment (12/17/08) (amended 2009/05/11)	TSO-C74d
CAN-TSO-C75	Hydraulic Hose Assemblies (12/15/62)	TSO-C75
CAN-TSO-C76a	Fuel Drain Valves (02/16/2007) (amended 2008/10/30)	TSO-C76a
CAN-TSO-C77b	Gas Turbine Auxiliary Power Units (12/20/00) (amended 2001/10/01)	TSO-C77b (amended 2001/10/01)
CAN-TSO-C78a	Crewmember Demand Oxygen Masks (05/27/08) (amended 2009/05/11)	TSO-C78a
CAN-TSO-C79	Fire Detectors (Radiation Sensing Type) (05/15/63)	TSO-C79
CAN-TSO-C80	Flexible Fuel and Oil Cell Material (08/01/63)	TSO-C80

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C85b	Survivor Locator Lights (10/22/07) (amended 2009/05/11)	TSO-C85b
CAN-TSO-C87	Airborne Low-Range Radio Altimeter Equipment (08/04/64)	TSO-C87
CAN-TSO-C88b	Automatic Pressure Altitude Reporting Code-Generating Equipment (02/06/2007) (amended 2008/10/30)	TSO-C88b
CAN-TSO-C89a	Crewmember Oxygen Regulators, Demand (04/08/08) (amended 2009/05/11)	TSO-C89a
CAN-TSO-C90c	Cargo Pallets, Nets, and Containers (04/03/92)	TSO-C90c
CAN-TSO-C91a	Emergency Locator Transmitter (ELT) Equipment (04/29/85)	TSO-C91a
CAN-TSO-C92c	Ground Proximity Warning-Glide Slope Deviation Alerting Equipment (03/19/96)	TSO-C92c
CAN-TSO-C93	Airborne Interim Standard Microwave Landing System Converter Equipment (01/03/77)	TSO-C93
CAN-TSO-C95a	Mach Meters (08/31/07) (amended 2009/05/11)	TSO-C95a
CAN-TSO-C96a	Anticollision Lights System (04/07/89)	TSO-C96a
CAN-TSO-C97	Lithium Sulphur Dioxide Batteries (9/26/79)	TSO-C97
CAN-TSO-C99a	Flight Deck (Sedentary) Crewmember Protective Breathing Equipment (06/05/08) (amended 2009/05/11)	TSO-C99a
CAN-TSO-C100b	Child Restraint Systems (CRS) (07/16/02) (amended 2003/07/09)	TSO-C100b (amended 2003/07/09)
CAN-TSO-C101	Overspeed Warning Instruments (02/19/87)	TSO-C101
CAN-TSO-C102	Airborne Radar Approach and Beacon Systems for Helicopters (04/02/84)	TSO-C102
CAN-TSO-C103	Continuous Flow Oxygen Mask Assembly (For Non-Transport Category Aircraft) (04/12/84)	TSO-C103
CAN-TSO-C104	Microwave Landing Systems (MLS) Airborne Receiving Equipment (06/22/82)	TSO-C104
CAN-TSO-C105	Optional Display Equipment for Weather and Ground Mapping Radar Indicators (06/13/84)	TSO-C105
CAN-TSO-C106	Air Data Computer (01/15/88)	TSO-C106

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C109	Airborne Navigation Data Storage System (12/09/85)	TSO-C109
CAN-TSO-C110a	Airborne Passive Thunderstorm Detection Systems (10/26/88)	TSO-C110a
CAN-TSO-C112c	Air Traffic Control Radar Beacon System/Mode Select (ATCBS/Mode S) Airborne Equipment (12/18/08) (amended 2009/05/11)	TSO-C112c
CAN-TSO-C113	Airborne Multipurpose Electronic Displays (10/27/86)	TSO-C113
CAN-TSO-C114	Torso Restraint Systems (03/27/87)	TSO-C114
CAN-TSO-C115b	Airborne Area Navigation Equipment Using Multisensor Inputs (09/30/94)	TSO-C115b
CAN-TSO-C116a (amended 2010/05/27)	Crewmember Protective Breathing Equipment (07/30/2009) (amended 2010/05/27)	TSO-C116a (amended 2010/05/27)
CAN-TSO-C117a	Airborne Windshear Warning and Escape Guidance Systems for Transport Airplanes (08/01/96	TSO-C117a
CAN-TSO-C118	Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS I (08/05/88)	TSO-C118
CAN-TSO-C119c (amended 2010/05/27)	Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II (04/14/2009) (amended 2010/05/27)	TSO-C119c (amended 2010/05/27)
CAN-TSO-C121a	Underwater Locating Devices (Acoustic)(Self-Powered) (07/21/2006) (amended 2007/07/16)	TSO-C121a (amended 2007/07/16)
CAN-TSO-C122a	Equipment that Prevents Blocked Channels Used In Two -Way Radio Communications Due To Simultaneous Transmissions (08/26/05) (amended 2007/03/08)	TSO-C122a (amended 2007/03/08)
CAN-TSO-C123b	Cockpit Voice Recorder Equipment (06/01/2006) (amended 2007/07/16)	TSO-C123b (amended 2007/07/16)
CAN-TSO-C124b	Flight Data Recorder System (04/10/2007) (amended 2008/10/30)	TSO-C124b

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C126a	406 MHz Emergency Locator Transmitter (ELT) (12/17/08) (amended 2009/05/11)	TSO-C126a
CAN-TSO-C127a	Rotorcraft, Transport Airplane, and Normal and Utility Airplane Seating Systems (8/21/98) (amended 2001/10/01)	TSO-C127a (amended 2001/10/01)
CAN-TSO-C128a	Equipment that Prevents Blocked Channels Used in Two-way Radio Communications Due to Unintentional Transmission (08/26/05) (amended 2007/03/08)	TSO-C128a (amended 2007/03/08)
CAN-TSO-C129a	Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS) (02/20/96)	TSO-C129a
CAN-TSO-C132	Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment (03/25/04) (amended 2007/03/08)	TSO-C132 (amended 2007/03/08)
CAN-TSO-C135a (amended 2010/05/27)	Transport Category Airplane Wheels and Wheel and Brake Assemblies (07/02/2009) (amended 2010/05/27)	TSO-C135a (amended 2010/05/27)
CAN-TSO-C137a	Aircraft Portable Megaphones (01/30/08) (amended 2009/05/11)	TSO-C137a
CAN-TSO-C139	Aircraft Audio Systems and Equipment (08/05/05) (amended 2007/03/08)	TSO-C139 (amended 2007/03/08)
CAN-TSO-C140	Aerospace Fuel, Engine Oil, and Hydraulic Fluid Hose Assemblies (07/17/02) (amended 2004/06/08)	TSO-C140 (amended 2004/06/08)
CAN-TSO-C141	Aircraft Fluorescent Lighting Ballast/Fixture Equipment (8/17/99) (amended 2001/10/01)	TSO-C141 (amended 2001/10/01)
CAN-TSO-C142a	Non-rechargeable Lithium Cells and Batteries (08/07/2006) (amended 2007/07/16)	TSO-C142a (amended 2007/07/16)
CAN-TSO-C144a	Passive Airborne Global Navigation Satellite System (GNSS) Antenna (03/30/2007) (amended 2008/10/30)	TSO-C144a

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C145c	Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite Based Augmentation System (05/02/08) (amended 2009/05/11)	TSO-C145c
CAN-TSO-C146c	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite Based Augmentation System (02/09/08) (amended 2009/05/11)	TSO-C146c
CAN-TSO-C147	Traffic Advisory System (TAS) Airborne Equipment (4/6/98) (amended 2001/10/01)	TSO-C147 (amended 2001/10/01)
CAN-TSO-C148	Aircraft Mechanical Fasteners (9/26/97) (amended 2001/10/01)	TSO-C148 (amended 2001/10/01)
CAN-TSO-C149	Aircraft Bearings (04/24/98)	TSO-C149
CAN-TSO-C150	Aircraft Seals (04/24/98)	TSO-C150
CAN-TSO-C151b	Terrain Awareness and Warning System (12/17/02) (amended 2003/07/09)	TSO-C151b (amended 2003/07/09)
CAN-TSO-C153	Integrated Modular Avionics Hardware Elements (05/06/02) (amended 2004/06/08)	TSO-C153 (amended 2004/06/08)
CAN-TSO-C154c (amended 2010/05/27)	Universal Access Transceiver (UAT) Automatic Dependent Surveillance - Broadcast (ADS-B) Equipment (12/02/2009) (amended 2010/05/27)	TSO-C154c (amended 2010/05/27)
CAN-TSO-C155	Recorder Independent Power Supply (02/03/05) (amended 2007/03/08)	TSO-C155 (amended 2007/03/08)
CAN-TSO-C157	Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment (09/20/04) (amended 2007/03/08)	TSO-C157 (amended 2007/03/08)
CAN-TSO-C158	Aeronautical Mobile High Frequency Data Link (HFDL) Equipment (08/19/04) (amended 2007/03/08)	TSO-C158 (amended 2007/03/08)
CAN-TSO-C159	Avionics Supporting Next Generation Satellite Systems (NGSS) (09/20/04) (amended 2007/03/08)	TSO-C159 (amended 2007/03/08)

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C160	VDL Mode 2 Communications Equipment (01/11/08) (amended 2009/05/11)	TSO-C160
CAN-TSO-C161a (amended 2010/05/27)	Ground Based Augmentation System Positioning and Navigation Equipment (12/17/2009) (amended 2010/05/27)	TSO-C161a (amended 2010/05/27)
CAN-TSO-C162a (amended 2010/05/27)	Ground Based Augmentation System Very High Frequency Data Broadcast Equipment (12/17/2009) (amended 2010/05/27)	TSO-C162a (amended 2010/05/27)
CAN-TSO-C163a	VDL Mode 3 Communications Equipment Operating within the Frequency Range 117.975-137.000 Megahertz (08/31/07) (amended 2009/05/11)	TSO-C163a
CAN-TSO-C164	Night Vision Goggles (09/30/04) (amended 2007/03/08)	TSO-C164 (amended 2007/03/08)
CAN-TSO-C165	Electronic Map Display Equipment for Graphical Depiction of Aircraft Position (09/30/03) (amended 2007/03/08)	TSO-C165 (amended 2007/03/08)
CAN-TSO-C166b (amended 2010/05/27)	Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information (12/02/2009) (amended 2010/05/27)	TSO-C166b (amended 2010/05/27)
CAN-TSO-C167	Personnel Carrying Device Systems (PCDS), also Known as Human Harnesses (06/09/04) (amended 2007/03/08)	TSO-C167 (amended 2007/03/08)
CAN-TSO-C168	Aviation Visual Distress Signals (03/25/04) (amended 2004/06/08)	TSO-C168 (amended 2004/06/08)
CAN-TSO-C169a	VHF Radio Communications Transceiver Equipment Operating within the Radio Frequency Range 117.975 to 137.000 Megahertz (09/28/07) (amended 2009/05/11)	TSO-C169a

CAN-TSO Number	Subject	FAA TSO Number
CAN-TSO-C170	High Frequency (HF) Radio Communications Transceiver Equipment Operating within the Radio Frequency 1.5 to 30 Megahertz (12/20/04) (amended 2007/03/08)	TSO-C170 (amended 2007/03/08)
CAN-TSO-C171	Aircraft Clamps (05/02/05) (amended 2007/03/08)	TSO-C171 (amended 2007/03/08)
CAN-TSO-C173	Nickel-Cadmium and Lead-Acid Batteries (05/02/05) (amended 2007/03/08)	TSO-C173 (amended 2007/03/08)
CAN-TSO-C174	Battery Based Emergency Power Unit (BEPU) (amended 2007/03/08)	TSO-C174 (amended 2007/03/08)
CAN-TSO-C175	Galley Cart, containers and Associated Components (11/04/2005) (amended 2007/07/16)	TSO-C175 (amended 2007/07/16)
CAN-TSO-C176	Aircraft Cockpit Image Recorder Systems (07/28/2006) (amended 2007/07/16)	TSO-C176 (amended 2007/07/16)
CAN-TSO-C177	Data Link Recorder Systems (07/28/2006) (amended 2007/07/16)	TSO-C177 (amended 2007/07/16)
CAN-TSO-C178	Single Phase 115 VAC, 400 Hz Arc Fault Circuit Breakers (03/03/2006) (amended 2007/07/16)	TSO-C178 (amended 2007/07/16)
CAN-TSO-C179	Rechargeable Lithium Cells and Lithium Batteries (08/22/2006) (amended 2007/07/16)	TSO-C179 (amended 2007/07/16)
CAN-TSO-C190	Active Airborne Global Navigation Satellite System (GNSS) Antenna (03/20/2007) (amended 2008/10/30)	TSO-C190
CAN-TSO-C194	Helicopter Terrain Awareness and Warning System (HTAWS) (12/17/08) (amended 2009/05/11)	TSO-C194
CAN-TSO-C196 (amended 2010/05/27)	Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation (09/21/2009) (amended 2010/05/27)	TSO-C196 (amended 2010/05/27)

SUBCHAPTER C
RESERVED
(amended 2009/12/01)

537.201 ***Reserved***
(amended 2005/12/01)

537.203 ***Reserved***
(amended 2009/12/01)

537.205 ***Reserved***
(amended 2005/12/01)

537.207 ***Reserved***
(amended 2005/12/01)

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 541 - AIRSHIPS

Canada

Available through your local book seller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Fax: (613) 954-5779 or 1-800-661-2868
Orders only: 1-800-635-7943
Internet: http://publications.communication.gc.ca

Catalogue No.: T51-15/541-2005E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
01 Dec. 2005	13 Feb. 2006	

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL
CHAPTER 541 - AIRSHIPS

Table of Contents

Procurement of Reference Publication

The title of the publication referenced in this Chapter of the *Airworthiness Manual* is as follows:

FAA-P-8110-2, Change 1, Airship Design Criteria. (July 24, 1992).

Orders for this publication may be sent to the following address, together with the appropriate remittance:

U.S. Department of Transportation
Subsequent Distributing
Section M-49403,
Washington, DC 20590

FAA-P-8110-2, Change 1, is published only in English. However, Transport Canada has produced a French translation and both of these documents may be consulted at:

Transport Canada Library (AFCHAG)
Transport Canada Building
Place de Ville, Tower C
330 Sparks Street
Ottawa, Ontario
K1A 0N8

Tel. (613) 998-5128

Preamble

General

The purpose of this Airworthiness Standard is to provide acceptable airworthiness requirements for the type certification of airships in the normal category.

First Edition **Effective: May 1, 1996**

Originally, Chapters 541 and 543 were reserved for small and large airships respectively, however, in the interest of simplification and cost reduction, all airship standards have been combined in Chapter 541, with the section for large airship standards reserved for the present.

Change 541-1 **Published: December 1, 2005**

1. General

This change introduces a new amendment format. This new amendment format was originally introduced in Chapter 529 of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following procedures are introduced in this Change 541-1:

- the preamble will be the focal point regarding the sections affected by this Change. For the current change only, an amendment tag identifying the coming into force date of the provision will follow the amended text. {example: (amended 2003/09/01)}

- on the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted but followed by an electronic link to the previous version of the modified text. {example: (amended 2003/09/01; previous version)}

- the preamble will include a table of change information. This table will include the Notices of Proposed Amendments (NPAs) with the corresponding amended sections.

2. CARAC Proposed Amendment Recommendations

This change implements the amendments to the standard recommended by the CARAC Technical Committee Part V.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2000-337	▪ 541.1

This amendment revises the applicability section of the chapter based on recommendations from the Department of Justice to reflect the repeal of the Air Regulations and the introduction of the CARs and the deletion of the "Enabling Authority" statement.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2000-338	▪ 541.5

This section has been rewritten for clarity and also to correct metric conversions. The standards of section 541.5 have been reorganized from small to large airships by renumbering the paragraphs. The text of the paragraphs has been rewritten for the purpose of making it more user friendly. There are no changes to the rules.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2000-339	▪ 541.5

This amendment revises the requirements of the airship standards section in order to achieve harmonization with the Federal Aviation Administration's airship design standards document number FAA-P-8110-2.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2000-340	▪ 541.9 541.11

This amendment deletes the requirements in sections 541.9 and 541.11 since they are addressed in section 541.5 as amended by NPA 2000-339.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2000-341	▪ 541.15

This amendment cancels certain unique requirements addressing the use of metric units in the flight manual.

Table of Change Information	
Notice of Proposed Amendment	**Amended Sections**
▪ 2001-017	▪ 541.15

This amendment cancels the remaining requirements that address the use of metric units in the flight manual. This change completes the process of harmonizing the unit requirements in the flight manual for this chapter with that of the other design chapters in Part V.

Change 541-2 **Published: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the *Canadian Aviation Regulations* (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends section 541.1 to reflect changes in legal drafting style, in terminology and in references introduced because of CAR 521. In addition, subsection 521.31(1) of the CARs is now used to legally enable this Chapter of the AWM.

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL
CHAPTER 541 AIRSHIPS

SUBCHAPTER A

541.1 ***Applicability***

(a) This Chapter sets out airworthiness standards for the issuance of type certificates and changes to type certificates for non-rigid, near-equilibrium airships of conventional design and construction in the normal category.
(amended 2009/12/01)

(b) Reserved.
(amended 2009/12/01)

541.3 ***Definitions***

For the purpose of this chapter:

An *Airship* is an engine driven, lighter-than-air aircraft that can be steered.

A *Captive-gas Airship* is an airship that derives its lift from a captive lighter-than-air gas.

A *Hot-air Airship* is an airship that derives its lift from heated air.

541.5 ***Airship Standards***

(a) Subject to paragraph (b), airships that have a seating configuration, excluding pilot seats, of up to 9 seats, shall meet the standards set out in the Federal Aviation Administration document FAA-P-8110-2 entitled "Airship Design Criteria" as amended by Change 2, dated February 6, 1995, and where a reference is made to Parts of the *Federal Aviation Regulations* (FARs), the applicable *Canadian Aviation Regulations* (CARs) and chapters of the *Airworthiness Manual* shall be substituted therefor.
(amended 2005/12/01)

(b) Airships that have a seating configuration, including pilots seats, of not more than 4 seats with a maximum displacement of 4 250 m^3 (150,087 cu. ft.) in the case of a hot-air airship, or 1 840 m^3 (64,979 cu. ft.) in the case of a captive-gas airship, may be designed to meet the applicable standards set out in:
(amended 2005/12/01)

(1) Chapter 531, "Manned Free Balloons" of the *Airworthiness Manual* provided it can be demonstrated that with the engines shut-off the aircraft may be operated as a free balloon; and
(amended 2005/12/01)

(2) Chapter 522, "Gliders and Powered Gliders", Subchapter E, for the powerplant unless approved as an integral part of the airship.
(amended 2005/12/01)

(c) Airships that have a seating configuration, excluding pilot seats, of more than 9 seats shall meet the following standards:
(amended 2005/12/01)

(1) (Reserved)

541.7 *Lifting Gas*

Hydrogen is not an acceptable lifting gas for use in airships.

541.9 *Reserved*

(amended 2005/12/01)

541.11 *Reserved*

(amended 2005/12/01)

541.13 *Markings and Placards - Fuel and Oil Filler Openings*

In addition to the requirements of paragraph 7.21(c) of FAA-P-8110-2, where placards and markings at the fuel or oil filler openings include tank capacity, the capacity must be specified in litres. Imperial or U.S. gallons may also be included.

541.15 *Reserved*

(amended 2005/12/01)

Transport Canada   Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 551 - AIRCRAFT EQUIPMENT AND INSTALLATION

Canada

Available through your local book seller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Fax: (613) 954-5779 or 1-800-661-2868
Orders only: 1-800-635-7943
Internet: http://publications.communication.gc.ca

Catalogue No.: T51-15/551-2009E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2009-2 (2009/12/01)	[illegible]	[illegible]
2011-2 (?)	[illegible]	[illegible]

Date of Amendment	Date Entered	Entered by

AIRWORTHINESS MANUAL
CHAPTER 551 - AIRCRAFT EQUIPMENT AND INSTALLATION

Table of Contents

Interpretation Provision for Part V Standards

In these Standards:

(a) The passages giving the Minister power to determine, approve or authorise something without stating criteria for the use of such power are to be interpreted as requiring that the power be used in consideration of two factors only:

the airworthiness of the aircraft that is the subject of the determination, approval or authorisation, or on which an aeronautical product that is the subject of the determination, approval or authorisation is to be installed, and the aircraft's level of safety;

(b) The word "approved", when used without any indication of a method of approval, is to be interpreted as referring to an approval granted under the Aeronautics Act.

Procurement of Reference Publication

Copies of publications referenced in this Chapter of the Airworthiness Manual may be obtained from the following sources:

(a) European Organisation for Civil Aviation Equipment (EUROCAE) Documents

EUROCAE documents may be purchased from the European Organisation for Civil Aviation Equipment, 17 Rue Hamelin, 75783 Paris Cedex 16, France.

(b) Radio Technical Commission for Aeronautics (RTCA) Documents

RTCA documents may be purchased from the RTCA Inc., 1140 Connecticut, NW, Suite 1020, Washington, D.C. 20036, USA.

(c) Industry Canada Documents

Industry Canada documents may be obtained from Industry Canada, 300 Slater Street, Ottawa, Ontario K1A 0C8.

(d) CAN/CGSB Documents

CAN/CGSB documents may be obtained from Sales Centre, Canadian General Standards Board, Ottawa, Ontario K1A 1G6.

Preamble

First Edition **Effective: December 1, 1998**

In the early nineties Transport Canada Civil Aviation identified the remaining additional operating requirements, contained in U.S. Code of Federal Regulations, Title 14, Part 91, 121, 127, 133 and 135, to be adapted and incorporated into a "Canadian code", as recommended by the Dubin Commission of Inquiry into Aviation in 1982.

A study was commissioned to SYPHER-MUELLER International Inc. to isolate those additional operating requirements for which there were no equivalent in Canada; and to analyse the potential impact of their incorporation in the Canadian Code. The results of this study were used in the development of Part VI and VII of the *Canadian Aviation Regulations* (CARs).

These CARs state that the required aircraft equipment must meet the applicable standards of airworthiness related to the design, manufacture and maintenance of aeronautical products. This chapter, published pursuant to Part V, Subpart 51 of the CARs, sets out standards of airworthiness for the design and installation of some of the aircraft equipment required by CAR Part VI or Part VII.

The standards contained in this chapter have been developed by a joint Transport Canada and aviation industry working group established by the Canadian Aviation Regulation Advisory Council (CARAC), Technical Committee V. The working group's first priority was to develop equipment standards to replace those remaining in the Engineering and Inspection Manual (E&I).

This chapter supersedes the following sections of the Engineering and Inspection Manual, which remains only as an historic document for past reference.

Engineering and Inspection Manual, Part II, Chapter III		**Superseded by**
Section	**Title**	
3.1	Restraint of Carry-On Baggage	551.500
3.5	Portable Fire Extinguishers	551.400
3.9	Flight Data Recorders	551.100
3.10	Cockpit Voice Recorders	551.101
3.12	Emergency Locator Transmitter Systems	551.104
3.13	Ground Proximity Warning Systems	551.102

Engineering and Inspection Manual, Part II, Chapter III		Superseded by
Section	Title	
3.14	Air Traffic Control Transponder and Automatic Pressure Altitude Reporting Equipment	551.103
3.15	Safety Belts	551.406

While Chapter 537 "Appliances" of the *Airworthiness Manual* specifies the current standards for the issuance of a Type Certificate of new aviation appliances and is designer/manufacturer oriented, Chapter 551 lists acceptable design standards as well as installation standards for use by installers and users of these items of equipment.

Change 551-1 **Effective December 1, 2004**

In an effort to harmonize our regulatory guidance documents with those of other international aviation authorities and other branches within Transport Canada Civil Aviation (TCCA), the Aircraft Certification Branch has decided to replace existing Airworthiness Manual Advisories (AMA) related to certification of aeronautical products with new Advisory Circulars (AC). While the content of the new ACs will remain technically the same as the corresponding AMAs, which they will replace, the format of the ACs will be standardized to conform to other guidance documents published within the branch.

This change in guidance documentation becomes effective 1 December 2004 at which time the AMAs will be cancelled and replaced by their corresponding Advisory Circular concurrent with the next publishing of the *Canadian Aviation Regulations* (CAR). After this time, the CARAC Secretariat will no longer publish these AMAs and, consequently, ACs will not be published with their corresponding AWM Chapter. As of the 1 December 2004 issue of the CARs, any affected AMA references and content will have been removed. However, the AMA Index found in AMA 500/00 will, for now, continue to exist to provide a cross-reference between the old AMAs and the new ACs.

Change 551-2 **Effective: December 1, 2005**

1. General

Change 551-2 introduces a new amendment format. This new amendment format was originally introduced in Chapter 529 of the *Airworthiness Manual* in order to be more consistent with the administrative procedures followed to amend the *Canadian Aviation Regulations* (CARs).

The following procedures are introduced in Change 551-2:

- the preamble is, as of Change 551-2, the focal point regarding the sections affected by Change 551-2 and future Changes. For the current change only, an amendment tag identifying the coming into force date of the provision will follow the amended text. {example: (amended 2003/06/01)

- On the paper version, new or revised text will be highlighted. In the electronic version, new or revised text will not be highlighted but followed by an electronic link to the previous version of the modified text. (example: amended 2003-06-01; previous version)
- the preamble will include a table of change information. This table will include the Notices of Proposed Amendments (NPAs) with the corresponding amended sections.

2. CARAC Proposed Amendment Recommendations

This change implements the amendments to the standard recommended by the CARAC Technical Committee Part V.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2000-333	• 551.10

This amendment provides standards of airworthiness for the approval of a tow hook/hitch and its release mechanism installed on aeroplanes for the purpose of towing gliders or banners.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2000-334	• 551.107

The Working Group noted in its final report that existing standards for radio communication equipment are adequate. However, the Working Group recommended that an information note be added to identify FAA Advisory Circular AC 23-8B (or later revision) as appropriate guidance material for evaluating installation of radio communication equipment required by CAR Part VI. This reference to acceptable advisory material will provide guidance on the evaluation of equipment installation to achieve acceptable installed performance.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2000-335	• 551.108

The Working Group noted in its final report that existing standards for radio navigation equipment are adequate. However, the Working Group recommended that an information note be added to identify FAA Advisory Circular AC 23-8B (or later revision) as appropriate guidance material for evaluating installation of radio navigation equipment required by CAR Part VI. This reference to acceptable advisory material will provide guidance on the evaluation of equipment installation to achieve acceptable installed performance.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2000-336	• 551.400

This amendment updates the information note in the hand-held fire extinguisher section to refer to the current accepted advisory material.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2001-019	• 551.407

This amendment is to add a section in the Airworthiness Manual (AWM) Chapter 551 to address the standards of airworthiness for aircraft passenger transportation suit systems.

Table of Change Information	
Notice of Proposed Amendment	**Amended Section(s)**
• 2004-036	• 551.104

This amendment takes the specific requirements of the Emergency Locator Transmitters standard as specified in AWM Chapter 537 and incorporates them into AWM Chapter 551.

Change 551-3 **Effective: December 1, 2009**

On December 1, 2009, Part V Subpart 21 of the *Canadian Aviation Regulations* (CAR 521) came into force. CAR 521 replaces the following Regulations in Part V—Airworthiness:

Subpart 11 - Approval of the Type Design of an Aeronautical Product

Subpart 13 - Approval of Modification and Repair Designs

Subpart 16 - Aircraft Emissions

Subpart 22 - Gliders and Powered Gliders

Subpart 23 - Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Subpart 25 - Transport Category Aeroplanes

Subpart 27 - Normal Category Rotorcraft

Subpart 29 - Transport Category Rotorcraft

Subpart 31 - Manned Free Balloons

Subpart 33 - Aircraft Engines

Subpart 35 - Aircraft Propellers

Subpart 37 - Aircraft Appliances and Other Aeronautical Products

Subpart 41 - Airships

Subpart 51 - Aircraft Equipment

Subpart 91 - Service Difficulty Reporting

Subpart 93 - Airworthiness Directives

In addition, with publication of CAR 521, the following Chapters of the Airworthiness Manual have been withdrawn:

Chapter 511 - Approval of the Type Design of an Aeronautical Product

Chapter 513 - Approval of Modification and Repair Designs

Standard 591 - Service Difficulty Reporting

Standard 593 - Airworthiness Directives

This change amends Chapter 551 of the AWM to reflect changes in legal drafting style, in terminology and in references required because of the introduction of CAR 521. This change also amends the French text to correct inconsistencies between the French and English text.

(a) In addition to the above changes, this change:

(b) introduces requirements for crash axes in section 551.408;

(c) amends section 551.102 on Ground Proximity Warning Systems to introduce requirements for Terrain Awareness and Warning Systems;

(d) introduces requirements for child restraint systems in section 551.501, which had previously been in Chapter 537 of the AWM; and

amends the table of paragraph 551.403(c) to introduce the UL1180 Type II Standard with Canadian Addendum.

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL
CHAPTER 551 - AIRCRAFT EQUIPMENT AND INSTALLATION

(amended 1998/12/01)

SUBCHAPTER A
GENERAL

551.01 *Application*

Pursuant to subsection 521.31(2) of the *Canadian Aviation Regulations* (CARs), this Chapter specifies standards of airworthiness for the design and installation of aircraft equipment required by Part VI or Part VII of the CARs.
(amended 2009/12/01)

551.02 *Equipment Design Standards*

(a) Subject to (b), equipment installed or intended for installation in aircraft must meet the applicable requirements of:
(amended 2009/12/01)

(1) Part V, Subpart 21 of the CARs; or
(amended 2009/12/01)

(2) this chapter, where the equipment was already approved for use on aircraft.

Information Note:
Where a CAN-TSO is referenced as an acceptable standard of airworthiness, it is intended to mean that the design standards contained within the CAN-TSO are an acceptable minimum standard. However, the equipment does not necessarily need to have a Canadian Technical Standard Order (CAN-TSO) design approval; the equipment may be approved in a manner set out in section 521.02 of the CARs.
(amended 2009/12/01)

(b) Where there are no specific design standards, the equipment must provide the same level of safety as that established by the certification basis of the aircraft.
(amended 2009/12/01)

551.03 *Equipment Installation Standards*

In addition to meeting the requirements specified in this chapter, the installation of the equipment must meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.04 ***to*** **551.09** ***Reserved***

SUBCHAPTER B
MECHANICAL SYSTEMS

551.10 *Tow Hitch and Release Control System*
(amended 2005/12/01)

(a) General
(amended 2005/12/01)

This section contains standards of airworthiness for the approval of a tow hitch and its release mechanism for towing gliders or banners as required by section 602.22 of the CARs.

Information Note*: Section 602.22 of the CARs prohibits towing objects unless the aeroplanes are equipped with an approved tow hitch and release mechanism. The standards in this section apply only to glider and banner towing. The approval of tow hitches and release mechanisms for towing objects, other than gliders and banners will be evaluated on a case by case basis.*

(b) Equipment approval
(amended 2005/12/01)

Each tow hitch and its release mechanism not approved as part of the aircraft type design, must meet the minimum requirements contained in Chapter 8, section 126, paragraph (a) or (b) of FAA AC 43.13-2A, Change 2 dated October 30, 1989, respectively for glider or banner towing.
(amended 2009/12/01)

(c) Installation approval
(amended 2005/12/01)

In addition to complying with section 127, Structural testing, section 128, attachment points, section 129, Angles of tow, section 130, Placards and section 132, Tow release mechanism, of Chapter 8 of FAA AC 43.13-2A, Change 2, the following is required for certification approval:

(1) Tow Release Mechanism

The design of the release control must provide for a location which permits convenient operation by the pilot with seat belt and shoulder harness secured and which cannot be confused with other control handles. The release mechanism must be within pilot's reach with the flight controls in any possible position.
(amended 2009/12/01)

(2) Weight and Balance

A new Weight and Balance Report must be prepared according to the requirements of Appendix C of Standard 571 of the *Canadian Aviation Regulations*.
(amended 2009/12/01)

(3) Markings and Placards

The function and method of operation of the tow hitch release shall be on a placard mounted near the release control and in clear view of the pilot. The maximum load that can be applied to the tow hook must be on a placard in clear view of the pilot and specified as a limitation in any flight manual (or supplement) associated with towing.
(amended 2009/12/01)

(4) Towing Approval and Flight Manual Supplement

An aeroplane that is to be used to tow gliders, banners, or other objects must be approved for that purpose and be provided with an appropriate flight manual supplement.
(amended 2009/12/01)

Information Note: *Refer to AC 523-007 for additional advisory material on glider and banner towing.*
(amended 2005/12/01)

551.11 ***to*** **551.99** ***Reserved***
(amended 2005/12/01)

SUBCHAPTER C
AVIONIC SYSTEMS

551.100 *Flight Data Recorder*

(a) Introduction

This section contains standards of airworthiness for installation approval of Flight Data Recorder (FDR) required by CAR 605.33.

(b) Definitions

In this section,

"Initial installation" means the first installation of a particular type of FDR in an aircraft of a particular type and model;

"Flight Data Recorder (FDR)" means a system of flight data recording equipment; and

"Follow-on series FDR installation" means an installation that is accomplished in conformity with approved data derived from the initial installation of the same type and model of FDR and aircraft.

(c) Equipment

These design standards in the following documents apply:

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO C124a (amended 2009/12/01)	Acceptable
Other:	

Standard	Criteria for Acceptance for Installation
CAN-TSO C124 (amended 2009/12/01)	Acceptable
CAN-TSO C51a (amended 2009/12/01)	May remain in use for existing installations approved prior to 1 December 1998 (the date of issue of CAR 551), provided the equipment is capable of meeting the Aircraft Equipment and Maintenance Standards (Standard 625)

(d) Installation

(1) Installation

FDR system installation must be in accordance with European Organisation for Civil Aviation Equipment (EUROCAE) document ED-55, "Minimum Operational Specification for Flight Data Recorder Systems", section 2.11, dated May 1990. In the event of any conflict between the ED-55 document and the certification basis of the aircraft, the certification basis applies.
(amended 2009/12/01)

Information Note
For normal and transport category rotorcraft, the installation location requirements for non-ejectable record container of an FDR is set out in section 527.1459(b) and 529.1459(b) of Chapter 527 and 529 of the Airworthiness Manual.

Normally, for aeroplanes, an FDR installation location at the aft would satisfy the requirements. However, for rotorcraft, the forward locations are generally less susceptible to fire and it may be preferable to install the record containers in a forward location. In addition, a forward location may avoid a significant weight penalty in comparison to an aft location.

It is therefore acceptable to install FDR non-ejectable record containers in forward locations of rotorcraft provided that the recorders are certified to CAN-TSO-C124a or CAN-TSO-C124 crash survivability standards.
(amended 2009/12/01)

(2) Recorder Operation and Termination

FDR system operation and termination must be in accordance with EUROCAE ED-55, sections 2.4.1 and 2.4.2
(amended 2009/12/01)

(3) Data Sources

Subject to the certification basis of the aircraft. each FDR system may obtain data on the parameters specified in Standard 625.33 whenever practical and permissible from the sources in the aircraft, or from transducers specifically installed and calibrated for correctly sensing the parameters.
(amended 2009/12/01)

(4) Calibration and Correlation

(i) Initial Installation

Each initial installation must be tested in the aircraft in which it is installed to demonstrate compliance with the system accuracy requirements of Standard 625.33 over the full range of each required parameter. The test must establish calibration and correlation data for each parameter.
(amended 2009/12/01)

In order to obtain approval for initial installations, the following information is required:

(A) A report providing:

A description of the means utilised to convert the data sensed at the source into signals suitable for input to the Flight Data Acquisition Unit of the FDR,

In respect of each parameter, conversion data and logic for translation of the recorded data stream into parameters expressed in engineering units;

(B) Reports of all tests of the full FDR system including calibration results and correlation data derived from the system accuracy tests;

(C) A maintenance plan; and

(D) Two copies of the operating, servicing, and maintenance instructions.

Information Note:
If a Supplement to the Aircraft Flight Manual or equivalent publication is produced, it must be submitted to Transport Canada for approval.

(ii) Follow-on Series FDR Installations

Each follow-on series FDR installation must be subjected to sufficient testing to confirm conformity with the calibration and correlation data applicable to the initial installation.
(amended 2009/12/01)

551.101 *Cockpit Voice Recorder*

(a) Introduction

This section contains standards of airworthiness for installation approval of Cockpit Voice Recorder (CVR) required by CAR 605.33.

(b) Definitions

In this section,

"Initial installation" means the first installation of a particular type of CVR in an aircraft of a particular type and model, for which approval is sought;

"Cockpit Voice Recorder (CVR)" means a system of flight data recording equipment; and

"Follow-on series CVR installation" means an installation that is accomplished in conformity with approved data derived from the initial installation of the same type and model of CVR and aircraft.

(c) Equipment

The design standards in the following documents apply:

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO C123a (amended 2009/12/01)	Acceptable
Other: CAN-TSO C123 (amended 2009/12/01) CAN-TSO C 84 (amended 2009/12/01)	 Acceptable May remain in use for existing installations, approved prior to 1 December 1998 (the date of issue of CAR 551) (amended 2009/12/01)

(d) Installation

(1) Installation and Installed Performance

CVR system installation and installed performance must be in accordance with European Organisation for Civil Aviation Equipment (EUROCAE) document ED-56A, "Minimum Operational Requirements for Cockpit Voice Recorder System", Chapter 6, dated October, 1993. In the event of any conflict between the ED-56A document and the certification basis of the aircraft, the basis of certification applies.
(amended 2009/12/01)

Information Note:
For normal and transport category rotorcraft, the installation location requirements for record container of a CVR is set out in section 527.1457(e) and 529.1457(e) of Chapter 527 and 529 of the Airworthiness Manual.

Normally, for aeroplanes, a CVR installation location at the aft would satisfy the requirements. However, for rotorcraft, the forward locations are generally less susceptible to fire and it may be preferable to install the record containers in a forward location. In addition, a forward location may avoid a significant weight penalty in comparison to an aft location.

It is therefore acceptable to install CVR record containers in forward locations of rotorcraft provided that the recorders are certified to CAN-TSO-C123a or CAN- TSO-C123 crash survivability standards.
(amended 2009/12/01)

(2) Initial Installation

Each initial installation must be tested in the aircraft in which it is installed to demonstrate compliance with the system recording requirements of Standard 625.33. The tests must be conducted in accordance with the procedures specified in EUROCAE ED-56A.

In order to obtain approval for initial installations, the following information is required:

(i) A test recording made under the noise conditions of flight operations, together with a report from a recognised CVR playback facility demonstrating that the quality and the intelligibility of the recorder information are satisfactory;

Information Note:
It is acceptable to use a copy of the original recording for demonstrating compliance with this requirement.

(ii) For CVRs that utilise solid-state recording media, software documentation including conversion and logic data for retrieval of the recorded information;

(iii) A maintenance plan; and

(iv) Two copies of the operating, servicing, and maintenance instructions.

Information Note:
If a Supplement to the Aircraft Flight Manual or equivalent publication is produced, it must be submitted to Transport Canada for approval.

(3) Follow-on Series CVR Installation

Each follow-on series CVR installation must be subjected to testing to confirm conformity with the data applicable to the initial installation.
(amended 2009/12/01)

551.102 *Terrain Awareness and Warning System (TAWS) and Ground Proximity Warning System (GPWS)*
(amended 2009/12/01)

(a) Introduction

This section contains standards of airworthiness for installation approval of Terrain Awareness and Warning Systems (TAWS) and Ground Proximity Warning System (GPWS) equipment.
(amended 2009/12/01)

(b) Equipment

(1) The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current – as contained in Chapter 537: CAN-TSO-C151b (amended 2009/12/01)	Acceptable, provided the conditions of (b)(3) are met. (amended 2009/12/01)
Current - as contained in Chapter 537: CAN-TSO C92c (amended 2009/12/01)	Acceptable

Other:	
CAN-TSO C151a (amended 2009/12/01)	Acceptable, provided the conditions of (b)(3) are met. (amended 2009/12/01)
CAN-TSO C92b (amended 2009/12/01)	Acceptable, provided the equipment has been approved for the installation in the subject aircraft prior to 26 April 1988 and the operator demonstrates that the equipment is compatible with the aircraft in which it is installed and the operating environment. (amended 2009/12/01)
CAN-TSO C92a (amended 2009/12/01)	Acceptable, provided the equipment has been approved for installation in the subject aircraft prior to 26 April, 1988 and the operator demonstrates that the equipment is compatible with the aircraft in which it is installed and the operating environment. (amended 2009/12/01)

(2) Ground Proximity Warning Systems (GPWS) must be installed to provide for the following warning envelopes as specified in section 2.1 of Radio Technical Commission for Aeronautics (RTCA) document DO-161A, Minimum Performance Standards - Airborne Ground Proximity Warning Equipment, revised 27 May 1976:
(amended 2009/12/01)

(i) excessive rate of descent with respect to terrain (Mode 1);

(ii) excessive closure rate to terrain (Mode 2);

(iii) negative climb rate or altitude loss before acquiring 213 meters (700 feet) terrain clearance after take-off or missed approach (Mode 3); and

(iv) flights above terrain with less than 152 meters (500 feet) terrain clearance while the aeroplane is not in landing configuration (Mode 4).

(3) Terrain Awareness Warning System (TAWS) Altitude Accuracy must meet the alerting criteria of CAN-TSO-C151a or later version:
(amended 2009/12/01)

(i) without any pilot action or input;
(amended 2009/12/01)

(ii) independent of altimeter setting on the altimeter(s); and
(amended 2009/12/01)

(iii) independent of temperature and pressure deviations from the International Standard Atmosphere (ISA).
(amended 2009/12/01)

Information Note:

The Altitude Accuracy requirements of (b)(3) will become a certification requirement for all installations, at the same time that they become an operational requirement under CAR Part VI or Part VII. It is recommended, but not required, that certifications before that date, meet these Altitude Accuracy requirements. Information regarding the Vertical Position Source provided in FAA Advisory Circular AC 23-18 and AC 25-23 is superseded by the requirement in (b)(3).
(amended 2009/12/01)

(c) Optional Functions

(1) An installed Ground Proximity Warning System (GPWS) may also:

(i) provide a warning envelope for deviation from an instrument glide path (Mode 5, section 2.6 of DO-160A document);

(ii) include a guarded and witness wired switch inhibiting the operation of the entire system; and

(iii) include a guarded switch inhibiting only the Mode 4 warnings for flap positions other than normal landing flap.

(2) An installed Terrain Awareness and Warning System (TAWS) may also provide optional features as specified in CAN-TSO-C151a (or later version).
(amended 2009/12/01)

551.103 *Transponder and Automatic Pressure Altitude Reporting Equipment*

(a) Introduction

This section contains standards of airworthiness for installation approval of Transponder and Automatic Pressure Altitude Reporting Equipment as required by CAR 605.35.

(b) Equipment

The design standards in the following documents apply:

(1) Transponders
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO C74c (amended 2009/12/01)	Acceptable
Other: CAN-TSO C74b (amended 2009/12/01)	Acceptable

(2) Automatic Pressure Altitude Reporting Equipment

Standards	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO C88a (amended 2009/12/01)	Acceptable
Other: CAN-TSO C88 (amended 2009/12/01)	Acceptable

(c) Installation

Information Note: *Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.*
(amended 2009/12/01)

551.104 *Emergency Locator Transmitter*

(a) Introduction

This section contains standards of airworthiness for Emergency Locator Transmitter (ELT) equipment and for installation approval of Emergency Locator Transmitter (ELT) equipment required by section 605.38 of the CARs.
(amended 2005/12/01)

(b) Performance and Environmental Standards
(amended 2005/12/01)

The ELT must meet the performance and environmental standards of either:
(amended 2009/12/01)

(1) CAN-TSO-C91 or CAN-TSO-C91a; or
(amended 2009/12/01)

(2) CAN-TSO- C126.
(amended 2009/12/01)

(c) ELT Battery
(amended 2005/12/01)

(1) An approved battery is any battery or battery pack designed for installation in a specific ELT that, with the specified battery or battery pack installed, complies with the requirements of paragraph (b).

(2) Each approved battery pack must be permanently and legibly marked with the type, model, and part number, and ELT type and model for which it has been approved.
(amended 2009/12/01)

Information Note: *Refer to Airworthiness Notice B014 for a list of approved batteries and battery packs for ELTs.*

(3) Each ELT unit must be permanently and legibly marked with at least the type, model and part number of the battery or battery pack used to demonstrate initial compliance with the applicable performance and environmental standards, and may be marked with information concerning alternate approved batteries.
(amended 2009/12/01)

(4) For each approved battery or battery pack, except for those essentially unaffected during probable storage intervals, the useful life and expiration date must be established as follows:
(amended 2009/12/01)

(i) the useful life is the length of time after its date of manufacture or recharge that the battery or battery pack may be stored under normal environmental conditions without losing its ability to allow the ELT to meet the applicable performance standards of paragraph (b); and

(ii) the expiration date is the date of battery manufacture or recharge plus one half of its useful life.

(5) Either the expiration date or the date of manufacture or recharge and the useful life must be permanently and legibly marked on all ELT batteries.
(amended 2009/12/01)

(6) The battery or battery pack expiration date must be permanently and legibly marked on the outside of the ELT case.
(amended 2009/12/01)

(7) For a rechargeable battery, the ELT or battery pack manufacturer must establish a battery recharge procedure, a battery capacity test procedure and occurrence frequency, and capacity test acceptance criteria.
(amended 2009/12/01)

(d) Data Requirements
(amended 2005/12/01)

(1) To obtain airworthiness approval, the following information is required:

(i) manufacturer's operating instructions and equipment limitations, containing a statement identifying the type designation as prescribed in the applicable performance and environmental standard;

(ii) recommended installation instructions including preferred installation locations and orientation; applicable schematic diagrams; wiring diagrams; typical transmitter, antenna, and remote switch installation details; and applicable procedures and specifications. The specifications must set forth all limitations, restrictions or other conditions pertinent to the installation;
(amended 2009/12/01)

(iii) list of components by part number, including any alternate or optional components, that make up the equipment system complying with the applicable performance and environmental standards;

(iv) manufacturer's test reports substantiating compliance with the applicable performance and environmental standards;

(v) equipment data sheets specifying, within the prescribed range of operating conditions, the actual performance of equipment of the type with respect to each performance factor prescribed in the applicable standard;

(vi) instructions for continued airworthiness, which must include as a minimum, details of approved batteries and sources of supply; battery replacement or recharge instructions; battery capacity test procedures, if applicable; transmission or functional test procedures; procedures necessary to accomplish the performance tests specified in Standard 571 Appendix G; and for 406 Mhz ELTs, instructions to verify the aircraft 24 bit address or serialized protocol as applicable; and
(amended 2009/12/01)

(vii) for ELTs approved to the performance and environmental standards of CAN-TSO-C126, a sample COSPAS-SARSAT Registration Form.
(amended 2009/12/01)

(2) The ELT manufacturer must supply with each unit:
(amended 2009/12/01)

(i) a copy of the operating instructions and equipment limitations prescribed in (d)(1)(i), the installation instructions prescribed in (d)(1)(ii), equipment data sheets prescribed in (d)(1)(v), and the instructions for continued airworthiness prescribed in (d)(1)(vi), above; and

(ii) for ELTs approved to the performance and environmental standards of CAN-TSO-C126, a COSPAS-SARSAT Registration Form.
(amended 2009/12/01)

(e) Equipment
(amended 2005/12/01)

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current – As contained in Chapter 537: (amended 2009/12/01)	
CAN-TSO C91a (amended 2009/12/01)	Acceptable, provided the transmission frequency is either 121.5 MHz, or 121.5 MHz and 243.0 MHz. (amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
CAN-TSO C126 (amended 2009/12/01)	Acceptable, provided there is a 121.5MHz transmission that meets the requirements of CAN-TSO-C91a, as stated in section (e)(2) of CAN-TSO-C126. (amended 2009/12/01)
Other:	
CAN-TSO-C91 (amended 2009/12/01)	
Radio Standards Specification, RSS-147, Emergency Locator Transmitters Operating at 121.5 MHz or 121.5 MHz and 243.0MHz (Issued by Industry Canada):	Acceptable, provided the transmission frequency is either 121.5 MHz, or 121.5 MHz and 243.0 MHz. (amended 2009/12/01)
(a) RSS-147, Issue 2	Type F and W units manufactured before April 1, 1982.
(b) RSS-147, Issue 3	Type W units manufactured before April 1, 1982.
(c) RSS-147, Issue 3, as amended by Canada Gazette Part I Public Notice DGTR-015-77 of 17 December 1977. (amended 2009/12/01)	Type A, F and W units manufactured after September 30, 1977, but before April 1, 1982.
(d) RSS-147, Issue 3, with modified endurance requirement of 50 hours at -20 degrees C.	Type A and F units manufactured before October 1, 1977.

(f) Installation
(amended 2005/12/01)

(1) Where an aircraft of 5700 kg (12,566 pounds) maximum take-off weight or less is to carry passengers on a flight for which an ELT is required, a readily visible placard or equivalent means must be installed in each passenger cabin to inform passengers of the location and operation of the ELT.
(amended 2009/12/01)

(2) Types F, AF, AP

Except where otherwise stated, the following requirements apply to type F, AF, AP ELT installations in aeroplanes and helicopters:

(i) When installed in an aeroplane the ELT must be mounted with its sensitive axis pointing in the direction of flight.
(amended 2009/12/01)

(ii) When installed in a helicopter the ELT must be mounted with its sensitive axis pointing approximately 45 degrees downward from the normal forward direction of flight.
(amended 2009/12/01)

(iii) The ELT must be installed to withstand ultimate inertia forces of 10g upward, 22.5g downward, 45g forward and 7.5g sideward.
(amended 2009/12/01)

(iv) The location chosen for the ELT must be sufficiently free from vibration to prevent involuntary activation of the transmitter.
(amended 2009/12/01)

(v) ELTs must be located and mounted so as to minimise the probability of damage to the transmitter and antenna by fire or crushing as a result of crash impact.
(amended 2009/12/01)

(vi) The ELT must be accessible for manual activation and deactivation. If it is equipped with an antenna for portable operation, the ELT must be easily detachable from inside the aircraft.
(amended 2009/12/01)

(vii) The external surface of the aircraft must be marked to indicate the location of the ELT.
(amended 2009/12/01)

(viii) The ELT must not use the antenna of another avionics system.
(amended 2009/12/01)

(ix) The external antenna location must be chosen considering the following factors:
(amended 2009/12/01)

(A) The ELT antenna must be mounted as far away as possible from other Very High Frequency (VHF) antennas.
(amended 2009/12/01)

(B) The distance between the transmitter and antenna must be in accordance with the ELT manufacturer's installation instructions or other approved data.
(amended 2009/12/01)

(C) The position of the antenna must be such as to ensure essentially omni-directional radiation characteristics when the aircraft is in its normal ground or water attitude.
(amended 2009/12/01)

(D) The antenna must be mounted as far aft as possible.
(amended 2009/12/01)

(x) The ELT antenna must not foul other antennas in flight.
(amended 2009/12/01)

(xi) The ELT must be subjected to an operational test as specified in Appendix G, Chapter 571 of this manual.
(amended 2009/12/01)

(3) Types W and S

(i) ELTs of type W and S must be installed as specified in (f)(2)(iii) above with a means of quick release, and located as near to an exit as practicable without being an

obstruction or hazard to aircraft occupants.
(amended 2009/12/01)

(ii) Where the table of CAR 605.38 requires the carriage of one ELT of type W or S, that ELT must be readily accessible to passengers and crew; where the carriage of a second type W or S ELT is required, that ELT must be either located near a life raft pack, or attached to a life raft in such a way that it will be available or retrievable when the raft is inflated.
(amended 2009/12/01)

(iii) No ELT with a lithium or magnesium battery must be packed inside a life raft in an aircraft.

(4) Transmitter Remote Control

Where the ELT system includes a remote control system for activating and deactivating the transmitter, provision must be made to prevent inadvertent operation of the remote control and a placard displaying the following warning must be placed near each remote control:
(amended 2009/12/01)

"FOR AVIATION EMERGENCY USE ONLY.

UNAUTHORIZED OPERATION PROHIBITED."

(5) Battery Charging System

Where ELT batteries can be charged during flight, provision must be made to:
(amended 2009/12/01)

(i) indicate to the flight crew that charging is taking place; and

(ii) prevent battery discharge resulting from wiring short circuits occurring during normal service or from crash damage.

551.105 *Altitude Alerting System*

(a) Introduction

This section contains standards of airworthiness for installation approval of Altitude Alerting Systems or devices required by CAR 605.36.

(b) Installation

Each altitude alerting system or device must be able to:
(amended 2009/12/01)

(1) alert the pilot upon approaching a preselected altitude in either ascent or descent, by a sequence of:

(i) both aural and visual signals in sufficient time to establish level flight at that preselected altitude; or

(ii) visual signals in sufficient time to establish level flight at that preselected altitude, and when deviating above and below that preselected altitude, by an aural signal;

(2) provide the required signals from sea level to the highest operating altitude approved for the aircraft in which it is installed;

(3) preselect altitudes in increments that are commensurate with the altitudes at which the aircraft is to be operated;

(4) be tested without special equipment to determine proper operation of alerting signals; and

(5) accept necessary barometric pressure settings if the system or device operates on barometric pressure.

Information Note:
For operation below 3,000 feet AGL, the altitude alerting system or device need only provide one signal, either visual or aural. A radio altimeter may be included to provide the signal if the operator has an approved procedure for its use to determine decision height or minimum decent altitude, as appropriate.

551.106 *Thunderstorm Detection and Weather Radar Equipment*

(a) Introduction

This section contains standards of airworthiness for installation approval of thunderstorm detection and weather radar equipment required by CAR 703.65, 704.64 and 705.70.

(b) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537:	
CAN-TSO-C63c (amended 2009/12/01)	Acceptable
CAN-TSO-C110a (amended 2009/12/01)	Acceptable
Other:	
Weather radar systems installed prior to the issue of CAN-TSO C63c, 18 August, 1983 (amended 2009/12/01)	May remain in use
Thunderstorm detection systems installed prior to the issue of CAN-TSO-C110a, 26 October 1988	May remain in use

(c) Installation

Information Note:
Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.107 *Radiocommunication Equipment*
(amended 2005/12/01)

Information Notes:
(amended 2005/12/01)
(a) Installation of Radiocommunication equipment required by sections 602.117, 605.14, 605.15, 605.16, 605.18, 605.19, 605.20 and 605.21 of the CARs should be carried out according to manufacturers' instructions and tested and evaluated using Chapter 5 of FAA Advisory Circular AC 23-8B, as amended from time to time, as guidance.
(amended 2005/12/01)

(b) In addition, according to section 551.03 of the Airworthiness Manual, the installation of equipment must meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.108 *Radio Navigation Equipment*
(amended 2005/12/01)

Information Notes:
(amended 2005/12/01)

(a) Installation of Radio navigation equipment required by sections 605.14, 605.15, 605.16 and 605.18 of the CARs should be carried out according to manufacturers' instructions and tested and evaluated using Chapter 5 of FAA Advisory Circular AC 23-8B, as amended from time to time, as guidance.
(amended 2005/12/01)

(b) In addition, according to section 551.03 of the Airworthiness Manual the installation of equipment must meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.109 *to* 551.199 *Reserved*
(amended 2005/12/01)

SUBCHAPTER D
ELECTRICAL SYSTEMS

551.200 *Electrical Power System*

(a) Introduction

This section contains standards of airworthiness for loading of the aircraft electrical power system.

(b) Electrical Power System Loading

(1) The continuous load which may be placed on an electrical power source is dependent upon the configuration of the electrical system and must be determined as follows:
(amended 2009/12/01)

(i) For aircraft without a loadmeter in the electrical power system feeders, the total continuous load under worst case conditions must be no greater than 80% of the rated electrical power source capacity.
(amended 2009/12/01)

Information Note:
The remaining 20% of the capacity is reserved for charging the aircraft battery system and for intermittent loads.

(ii) For aircraft with a loadmeter in the electrical power system feeders, total continuous load may be up to 100% of the rated generator capacity.

Information Note:
With a loadmeter available, it is assumed that the flight crew is able to monitor the electrical load and adjust it to safe levels, if necessary.

(2) Electrical power sources must be able to furnish the required power at the proper voltage to each load circuit. Compliance must be shown, to account for the electrical loads applied to the electrical system in probable combinations and for probable durations, by:

(i) Electrical load analysis, if an analysis was a requirement for the initial certification of the aircraft type; or

(ii) Where an electrical load analysis was not a requirement for the initial certification of the aircraft type:

(A) By electrical load analysis; or

(B) By direct measurement of the electrical loads.

551.201 *Battery*

(a) Introduction

This section contains standards of airworthiness for battery capacity.

(b) Battery Capacity

Where a battery is required to provide emergency electrical power, the battery must have sufficient capacity to meet the emergency load demand in the event of a total generated power supply failure, for the period of time specified in the certification basis of the aircraft.
(amended 2009/12/01)

Information Note:
Where no time is specified in the certification basis of the aircraft, it is recommended that 30 minutes flying time would be appropriate depending upon the intended operation of the aircraft.
(amended 2009/12/01)

551.202 *to* 551.299 *Reserved*

SUBCHAPTER E
POWERPLANT SYSTEMS

551.300 *to* 551.399 *Reserved*

SUBCHAPTER F
EMERGENCY EQUIPMENT

551.400 *Hand-Held Fire Extinguisher*

(a) Introduction

This section contains standards of airworthiness for Hand-Held Fire Extinguishers required by Parts VI and VII of the CARs.
(amended 2009/12/01)

Information Note:
As required by Parts VI and VII of the CARs, hand-held fire extinguishers must contain a type and quantity of extinguishing agent suitable for the kinds of fires likely to occur in the compartment where the extinguisher is intended to be used. For crew and passenger compartments, hand-held fire extinguishers must be designed to minimize the hazard of toxic gas concentrations.
(amended 2009/12/01)

Refer to FAA Advisory Circular AC 20-42C, dated 7 March 1984, as amended from time to time as an acceptable guidance regarding the different types of extinguishers, minimum capacities, and hazards of toxic gas concentration.
(amended 2005/12/01)

(b) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for installation
Current - as contained in Chapter 537: CAN-TSO-C19b (amended 2009/12/01)	Acceptable
Other: Approved by Underwriters Laboratories of Canada, bearing ULC approval label	Acceptable
Approved by the British Civil Aviation Authority (BCAA) for aircraft use	Acceptable
Approved by the Federal Aviation Administration (FAA) for aircraft use. Includes extinguishers approved to CAN-TSO-C19b (amended 2009/12/01)	Acceptable
Approved by Underwriters Laboratories Inc. (U.L.), Factory Mutual Research Corporation to specification U.L. 1093 (construction and operation), and to specification U.L. 711 (rating and testing)	Acceptable
Approved by U.S. Coastguard under title 46 of the U.S. Code of Federal Regulations, for use in aircraft	Acceptable
Approved for aircraft use by the airworthiness authority of any country, whose standards are accepted by the Minister	Acceptable

(c) Installation

The installation of hand-held fire extinguishers must be such that when properly secured in its mounting:
(amended 2009/12/01)

(1) the extinguisher will remain secure when subjected to the ultimate inertia loads established by the aircraft certification basis of the aircraft, but not less than the following ultimate load factors:
(amended 2009/12/01)

Load Factors	Aeroplanes	Rotorcrafts
forward	9.0	4.0

Load Factors	Aeroplanes	Rotorcrafts
sideward	1.5	2.0
upward	2.0	1.5
downward	4.5	4.0

(2) the extinguisher will have a "quick release" function to enable easy removal from its mount.

(d) Identification and Marking

(1) The hand-held fire extinguisher must be identified and marked with the applicable specifications as determined by the approving authority per paragraph (b).
(amended 2009/12/01)

(2) A stowage compartment or stowage container that contains a hand-held fire extinguisher must be clearly marked as to its contents.
(amended 2009/12/01)

551.401 *Life Saving Equipment Over Water - Life Preservers*

(a) Introduction

This section contains standards of airworthiness for Life Preservers required by CAR 602.62.

(b) Definitions

In this section, a "life preserver" is a flotation device, which when properly worn by a person, will provide adequate buoyant force to support the body in a safe and stable position in water and provide a self-righting force to maintain the face above the water; (gilet de sauvetage).

(c) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537:	
CAN-TSO-C13f (amended 2009/12/01)	Acceptable
Other:	
CAN-TSO C13e (amended 2009/12/01)	Acceptable
CAN-TSO-C13d (amended 2009/12/01)	Acceptable
CAN-TSO-C13c (amended 2009/12/01)	To be acceptable, must be demonstrated to meet:

Standard	Criteria for Acceptance for Installation
	(i) the total buoyancy requirement for an adult life jacket of not less than 15.9 kg; (ii) gas inflation system must provide a buoyancy of not less than 14.5 kg; (iii) additional requirement for a survivor locator light.

(d) Installation

Information Note:
Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.402 *Life Saving Equipment Over Water - Individual Flotation Devices (IFD)*
(amended 2009/12/01)

(a) Introduction

This section contains standards of airworthiness for Individual Flotation Devices (IFDs) required by CAR 602.62.

(b) Definitions

In this section, an "Individual Flotation Devices" is a flotation device, which when used by a person, will provide an additional buoyant force to assist in supporting the body in water.

(c) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO-C72c (amended 2009/12/01)	Acceptable
Other: CAN-TSO-C72b (amended 2009/12/01)	Acceptable
CAN-TSO-C72a (amended 2009/12/01)	Acceptable
CAN-TSO-C72 (amended 2009/12/01)	Acceptable

(d) Installation

Information Note:
Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.403 *Life Saving Equipment Over Water - Personal Flotation Devices (PFD)*
(amended 2009/12/01)

(a) Introduction

This section contains standards of airworthiness for Personal Flotation Devices (PFDs) required by CAR 602.62.

(b) Definitions

In this section, a "Personal Flotation Devices" is a flotation device other than a life preserver or individual flotation device.

(c) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - CAN/CGSB- 65.11-M88, Personal Flotation Devices, Amendment No. 4 dated January 1997	Acceptable
CAN/CGSB- 65.15-M88 , Personal Flotation Devices for Children, Amendment No. 4 dated January 1997	Acceptable
UL1180 Type II Standard with Canadian Addendum (amended 2009/12/01)	Acceptable only when fitted with a manual only inflator per the Canadian Addendum to UL1180 Standard (amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Other:	
CAN/CGSB- 65.11-M88 , Personal Flotation Devices, published February 1988 and Amendments Nos. 1 through 3	Acceptable
CAN/CGSB- 65.15-M88 , Personal Flotation Devices for Children, published April 1988 and Amendments Nos. 1 through 3	Acceptable
CGSB- 65-GP-15M, Standard for: Personal Flotation Devices for Children dated August 1978	Acceptable
CGSB 65-GP-11, Standard for: Personal Flotation Devices dated October 1972	Acceptable

(d) Installation

Information Note:
Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.404 *Life Saving Equipment Over Water - Life Rafts*

(a) Introduction

This section contains standards of airworthiness for Life Rafts required by CAR 602.63.

(b) Definitions

In this section, "life raft" means a flotation device that meets the standards specified in Chapter 537 and 551 of the *Airworthiness Manual.*

(c) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO C70a (amended 2009/12/01)	Acceptable

Standard	Criteria for Acceptance for Installation
Other: CAN-TSO C70 (amended 2009/12/01)	Acceptable
CAN-TSO C12c (amended 2009/12/01)	Acceptable

(d) Installation

Information Note:
Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.405 *Protective Breathing Equipment (PBE)*
(amended 2009/12/01)

(a) Introduction

This section contains acceptable standards of airworthiness for Protective Breathing Equipment (PBE) required by Parts VI and VII of the CARs.
(amended 2009/12/01)

Information Note:
The operational requirements of CAR VI and VII require protective breathing equipment for two different roles:

(1) use of fixed or portable PBE by flight crewmembers (i.e. pilots, flight engineers, etc.) at their assigned duty stations on the flight deck - PBE is easily accessible for immediate use by the flight crew members at their duty stations (Note that per FAR 121.337, the FAA requires that these items of PBE meet TSO-C99 or TSO-C116); and
(amended 2009/12/01)

(2) use of portable PBE by all crewmembers (i.e. not just flight crew but includes flight attendants) when investigating and combating fires throughout the aircraft (Note that per FAR 121.337, the FAA requires that these items of PBE meet TSO-C116).

(b) Definitions (From CAR 101)

"protective breathing equipment" - means equipment designed to cover the eyes, nose and mouth of the wearer, or the nose and mouth where accessory equipment is provided to protect the eyes, and to protect the wearer from the effects of smoke, carbon dioxide or other harmful gases. (inhalateur protecteur)

(c) Equipment

The design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537: CAN-TSO-C116 (amended 2009/12/01)	Acceptable
CAN-TSO-C 99 (amended 2009/12/01)	Acceptable

(d) Installation

Information Note: *Although no installation standards are specified in this section, section 551.03 requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft. In addition, CAR Part VI and VII also specify installation requirements for PBE.*
(amended 2009/12/01)

551.406 *Seat Belt and Shoulder Harness*

(a) Introduction

This section contains standards of airworthiness for Seat Belts and Shoulder Harnesses required by CAR 605.22, 605.24, 702.44, 703.69, 704.68 and 705.75.

(b) Definitions (From CAR 101)

In this section,

"safety belt" means a personal restraint system consisting of either a lap strap or a lap strap combined with a shoulder harness, (ceinture de sécurité);

"shoulder harness" means any device that is used to restrain the upper torso of a person and that consists of a single diagonal upper torso strap or dual upper torso straps; (ceinture-baudrier).

(c) Equipment

The design standards in the following documents apply:

(1) Subject to (2), the design standards for seat belt and shoulder harness assemblies are as follows:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - as contained in Chapter 537:	
CAN-TSO-C22g (amended 2009/12/01)	Acceptable
CAN-TSO C114 (amended 2009/12/01)	Acceptable

Standard	Criteria for Acceptance for Installation
Other:	
CAN-TSO C22f (amended 2009/12/01)	Acceptable, except for aircraft that have been type certified with a later CAN-TSO standard (e.g. CAN-TSO-C22g) (amended 2009/12/01)
Safety belt or shoulder harness assemblies that are currently installed in the specific aircraft and that conform to the original aircraft type design	Acceptable
Other Seat Belt or Shoulder Assembly design that is approved or accepted by Transport Canada (e.g. Supplemental Type Certificate, etc.) (amended 2009/12/01)	Acceptable

(2) In addition to the design standard specified above, the following must be met: (amended 2009/12/01)

(i) Applicable CAR Part VI and VII operational requirements;

(ii) Each separate part of the safety belt assembly must be permanently and legibly marked as set out in Part II Subpart 1 of the CARs, and with the rated strength of the safety belt.
(amended 2009/12/01)

(iii) Each safety belt must be designed to be used by not more than one occupant at a time;
(amended 2009/12/01)

(iv) The correct method of wearing the safety belt, including the shoulder harness if fitted, must be obvious and convenient;
(amended 2009/12/01)

(v) The design of the shoulder harness must be such that the unlatching of, or the failure of one or both shoulder straps, as applicable, must not affect the integrity of the lap strap portion of the safety belt;
(amended 2009/12/01)

(vi) For safety belts including shoulder harnesses, the latching devices must be designed such that both the shoulder harness and the lap strap portions of the safety belt may be simultaneously released.
(amended 2009/12/01)

(d) Installation

Seat belt and shoulder harness installations are classified as major modifications and must be accomplished in accordance with approved or specified data, as required by CAR Part V,

Subpart 71 and Standard 571.
(amended 2009/12/01)

551.407 *Aircraft Passenger Transportation Suit Systems*
(amended 2005/12/01)

(a) Introduction
(amended 2005/12/01)

This section contains standards of airworthiness for aircraft passenger transportation suit systems to satisfy the requirements of:

(1) paragraph 602.63(7)(a) of the CARs for a helicopter passenger transportation suit system; or

(2) subparagraph 602.39(b)(iii) of the CARs for hypothermia protection.

(b) Definitions
(amended 2005/12/01)

In this section, "Aircraft Passenger Transportation Suit System" means a personal immersion suit system that reduces thermal shock upon entry into cold water, delays onset of hypothermia during immersion in cold water and provides some flotation to minimize risk of drowning, while not impairing the wearer's ability to evacuate from a ditched aircraft.

(c) Equipment
(amended 2005/12/01)

The design standards in the following documents apply to aircraft passenger transportation suit systems:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current - (amended 2009/12/01) CAN/CGSB- 65.17-99 "Helicopter Passenger Transportation Suit Systems", published December 1999	Acceptable
Other: CAN/CGSB- 65.17-M88 "Helicopter Passenger Transportation Suit Systems", published January 1988	Acceptable

Information Note*: The above standards do not satisfy the requirements of section 602.62 of the CARs for approved life preservers. It is intended that either a life preserver meeting the life preserver standards of this Chapter be worn with the aircraft passenger transportation suit system, or alternately that the aircraft passenger transportation suit system be certified as complying with the life preserver standards of this Chapter in addition to the above standards.*

(d) Installation / Stowage
(amended 2005/12/01)

Information Note*: Although no installation / stowage standards are specified in this section, section 551.03 of the Airworthiness Manual requires that the installation of equipment meet the applicable standards of the certification basis of the aircraft.*
(amended 2009/12/01)

551.408 *Crash Axe*
(amended 2009/12/01)

(a) Introduction
(amended 2009/12/01)

This section contains standards of airworthiness for a crash axe required by section 705.92 of the CARs.
(amended 2009/12/01)

(b) Definitions
(amended 2009/12/01)

In this section,
(amended 2009/12/01)

"Crash axe" means a hand tool to aid aircraft crewmembers in emergencies. The hand tool is to assist crewmembers in penetrating aircraft materials and prying, twisting and cutting jammed items that are impeding the crews' response to an emergency. *(Hache de secours)* (amended 2009/12/01)

(c) Equipment
(amended 2009/12/01)

The design standards in the following documents apply :
(amended 2009/12/01)

Standard	**Criteria for Acceptance for Installation**
Current: SAE AS5402	Acceptable

(d) Installation
(amended 2009/12/01)

Information Note:

Although no installation standards are specified in this section, section 551.03 of the Airworthiness Manual requires that the installation of equipment meet the applicable

standards of the certification basis of the aircraft.
(amended 2009/12/01)

551.409 ***to*** **551.499** ***Reserved***
(amended 2009/12/01)

SUBCHAPTER G
MISCELLANEOUS

551.500 *Restraint of Carry-On Baggage*

(a) Introduction

This section contains standards of airworthiness for installation approval of equipment for stowing and restraining of carry-on baggage required by CAR 602.86 and 705.42.

(b) Equipment designed to stow or restrain carry-on baggage, equipment and cargo, including over-head bins, racks and underseat restraint areas, must meet the applicable standards of the certification basis of the aircraft. In addition, underseat restraint areas must be designed to meet not less than the following ultimate load factors:
(amended 2009/12/01)

Load Factors	Aeroplanes	Rotorcrafts
forward	9.0	4.0
sideward	1.5	2.0
upward	2.0	1.5
downward	4.5	4.0

Information Note:
(i) Placarding requirements:

The maximum weight of the baggage that can be restrained in an area is determined by the design and approved as part of the original certification of the aircraft or as a modification. The certification basis of the aircraft requires that stowage and baggage areas be placarded for the maximum allowed weight. However, Airworthiness Manual Chapter 525, section 525.1557/ FAR Part 25.1557 (Transport Category aeroplanes) allows that underseat compartments designed for the storage of carry-on articles weighing not more than 9.1 kg (20 lbs) need not have a loading limitation placard. This may be applied to other aircraft categories as well, as long as the underseat stowage area is designed for the storage of carry-on articles weighing not more than 9.1 kg (20 lbs).
(amended 2009/12/01)

551.501 *Child Restraint Systems*
(amended 2009/12/01)

(a) Introduction
(amended 2009/12/01)

This section contains standards of airworthiness for the approval of child restraint systems as set out in section 605.28 of the CARs.
(amended 2009/12/01)

(b) Equipment
(amended 2009/12/01)

(1) Subject to (2) and (3), the design standards in the following documents apply:
(amended 2009/12/01)

Standard	Criteria for Acceptance for Installation
Current – as contained in Chapter 537: CAN-TSO-C100b	Acceptable for use in transport category aeroplanes
Other:	
Canada Motor Vehicle Safety Standards (CMVSS) No. 213 titled "Child Restraint Systems", effective April 5, 1990	Acceptable for restraint systems manufactured between April 5, 1990 and March 14, 1998
Motor Vehicle Restraint Systems and Booster Cushions Safety Regulations (RSSR) Section 6, titled "Child Restraint Systems" effective March 15, 1998 and subsequent amendments	Acceptable for restraint systems manufactured on or after this effective date
Canada Motor Vehicle Safety Standards (CMVSS) No. 213.1 titled "Infant Restraint Systems", effective April 5, 1990	Acceptable for restraint systems manufactured between April 5, 1990 and March 14, 1998
Motor Vehicle Restraint Systems and Booster Cushions Safety Regulations (RSSR) Section 7, titled "Infant Restraint Systems" effective March 15, 1998 and subsequent amendments	Acceptable for restraint systems manufactured on or after this effective date
Federal Motor Vehicle Safety Standard, (FMVSS) No. 213 (FMVSS 213), titled "Child Restraint Systems", published by the Government of the United States: (a) effective prior to amendment dated February 26, 1985	Acceptable for child restraint systems, except for Vest and harness-type, manufactured between January 1, 1981 and February 25, 1985, carrying the label "This child restraint system conforms to all applicable Federal Motor Vehicle Safety Standards"

Standard	Criteria for Acceptance for Installation
(b) amended effective February 26, 1985 and subsequent amendments	i) Acceptable for child restraint systems manufactured on or after this effective date and approved for use in aircraft, carrying two labels which read: This child restraint system conforms to all applicable Federal Motor Vehicle Safety Standards"; and ii) "This restraint is certified for use in motor vehicles and aircraft" printed in red lettering

(2) Tether straps, as required in automobiles, and as defined in the Motor Vehicle Restraint Systems and Booster Cushions Safety Regulations (RSSR) Section 6 and 7, are not authorized for use in aircraft.
(amended 2009/12/01)

(3) Combination Child Restraint Systems/Booster Cushions certified to both CMVSS 213 and CMVSS 213.2 standards are acceptable only when the internal harness system is installed and all child restraint system labelling requirements are met.
(amended 2009/12/01)

(4) Booster cushions and booster seats not meeting the above standards are not acceptable for use as Child Restraint Systems.
(amended 2009/12/01)

(5) Infant carriers that consist of a pouch, which holds the infant close to the wearer's body, are not acceptable for use as Child Restraint Systems.
(amended 2009/12/01)

(6) Infant "Belly" or "Loop" belts attached to a seat occupant's safety belt by feeding the occupant's belt segment through a loop on the infant's belt are not acceptable for use as Child Restraint Systems.
(amended 2009/12/01)

(7) A Child Restraint System installed in an aeroplane passenger seat must rely only upon passenger seat lap belts (pelvic restraints) to secure the device to the seat. No passenger seat lap belt may contact the child-occupant of the Child Restraint System.
(amended 2009/12/01)

Information Note:

Additional information, in the form of advisory material, is available on the use and preferred location of child restraint systems and recommended evacuation procedures for occupants of child restraint systems.
(amended 2009/12/01)

(c) Installation
(amended 2009/12/01)

Child restraint systems must be installed in a forward facing aeroplane passenger seat as per the applicable installation instructions provided by the manufacturer of the child restraint

system.
(amended 2009/12/01)

551.503 *to* **551.599** ***Reserved***
(amended 2009/12/01)

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

STANDARD 561 - APPROVED MANUFACTURERS

Canada

Available through your local book seller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Fax: (613) 954-5779 or 1-800-661-2868
Orders only: 1-800-635-7943
Internet: http://publications.communication.gc.ca

Catalogue No.: T51-15/561-2008E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2008-2 (2008/12/30)	2010/03/06	[illegible]
2009-1 (")	" "	[illegible]
2011-2 (")	" "	[illegible]
2009-2 (2009/12/01)		[illegible]

Date of Amendment	*Date Entered*	*Entered by*

STANDARD 561 — APPROVED MANUFACTURERS

Table of Contents

Preamble

This amendment replaces the former Chapter 561 of the *Airworthiness Manual*.

This new standard titled *Standard for Approved Manufacturers* has been developed in line with the overall *Canadian Aviation Regulations* (CARs) system, and sets out the requirements and procedures to follow pursuant to Subpart 61 of Part V of the Regulations, for the issuance and continued validity of a manufacturer certificate by the Minister with respect to the manufacture of aeronautical products referred to in Subpart 61 of Part V of the Regulations.

PART V - AIRWORTHINESS

STANDARD 561 — APPROVED MANUFACTURERS

(amended 2007/12/01)

561.01 *Reserved*

561.02 *Application*

Information Notes:

(i) Standard 561 is applicable to the manufacture of aeronautical products in respect of which a design approval has been issued with the exceptions noted under section 561.02 of the CARs, i.e.: standard or commercial parts, and any parts made during a repair or modification under section 571.06 of the CARs, including repairs approved under a Repair Design Approval (RDA) and modifications approved under a Supplemental Type Certificate (STC).
(amended 2009/12/01)

(ii) The making of aeronautical products as part of a repair or modification is a maintenance activity, and is controlled by section 571.06 of the CARs. This applies regardless of the means of design approval. The person signing the release shall have access to the applicable design data. The maintenance release covers the entire task, including the manufacture of the aeronautical product.
(amended 2009/12/01)

(iii) Where aeronautical products such as STC kits are manufactured for installation by another person, the aeronautical products must be accompanied by a statement of conformity issued under the control of the holder of a manufacturer certificate pursuant to Subpart 61 of Part V of the CARs.

561.03 *Manufacturer Certificate - Application, Issuance and Amendment*

(1) An application made pursuant to section 561.03 of the CARs consists of a letter to the Minister and a copy of the proposed manual required by section 561.07 of the CARs.

(2) In addition to the letter of application and manual required under subsection (1), the applicant submits to the Minister, where applicable, a copy of the authorization from the holder of the applicable Canadian design approval or equivalent foreign design approval to manufacture the aeronautical products referred to in the application.

(3) The applicant submits to the Minister, upon request by the Minister, any other documents supporting the application.

Information Notes:

(i) Subsection 561.03(2) of the CARs specifies that an applicant shall be the holder of the applicable design approval or be in possession of an agreement with the design approval holder. The expression "design approval" covers designs approved by the Minister, as well as

designs approved by the relevant foreign airworthiness authority.
(amended 2009/12/01)

(ii) As indicated in subsection 561.03(5) of the CARs, an applicant may apply for and be granted a manufacturer approval while still in the process of obtaining the design approval for the product or obtaining a licensing agreement for the aeronautical product concerned. However, the statement of conformity required by section 561.10 of the CARs must not be signed until the design has been approved or the licensing agreement has been secured.

(iii) If a manufacturer's facilities are at more than one location, including other countries pursuant to section 561.06 of the CARs, all locations may be included under one approval.

561.04 *Management Personnel*

(1) Except as provided in subsection 561.04(4) of the CARs, the person appointed under paragraph 561.04(1)(a) of the CARs meets the following standards of competence:

(a) in the case of an organization approved for the manufacture of aircraft or aircraft engines, has acquired a minimum of six years experience in the performance or direct supervision of technical activities of a similar complexity to those undertaken by the organization, three years of which have been in a supervisory capacity; and

(b) in the case of an organization approved for the manufacture of aeronautical products other than aircraft or aircraft engines, has acquired a minimum of three years experience in the performance or direct supervision of technical activities of similar complexity to those undertaken by the organization.

(2) Except as provided in subsection 561.04(4) of the CARs, within 30 days following the appointment, the person appointed demonstrates, during an interview to be conducted in accordance with subsections 561.04(2) and (3) of the CARs, knowledge of the following topics as they relate to the manufacturer's approved policies:

(a) the duties and responsibilities of the appointed position;

(b) the duties of persons who have been assigned functional responsibilities;

(c) the responsibilities of the holder of the manufacturer certificate, including responsibilities for work that has been contracted out;

(d) the responsibilities of persons authorized to sign statements of conformity pursuant to section 561.10 of the CARs;

(e) the functions of production control system and quality assurance program referred to in sections 561.08 and 561.09 of the CARs;

(f) the record keeping requirements;

(g) the identification of acceptable reference data;

(h) parts control and traceability; and

(i) the control of non-conforming parts and materials.

(3) Within the scope of the interview, the minister:

(a) records the questions and responses relating to each interview conducted under subsection (2);

(b) immediately informs the person interviewed of the results verbally upon conclusion of the interview; and

(c) provides written notification of the results of the interview and, if applicable, also provides a summary identifying those areas requiring further development to the person interviewed and the holder of the manufacturer certificate within 10 days as required by subsection 561.04(3) of the CARs.

Information Notes:

(i) Subsection 561.04(5) of the CARs requires the holder of a manufacturer certificate to provide the person appointed with the financial and human resources necessary to ensure compliance with Subpart 61 of Part V of the CARs and Standard 561. These should include the resources to identify quality problems and to initiate corrective actions to ensure compliance with the conditions of the manufacturer approval.

(ii) The person appointed may be the Accountable Executive, provided they meet the requirements of this section.

561.05 *Resources*

The following include the financial and human resources required pursuant to section 561.05 of the CARs:

(a) reasonable facilities;

(b) applicable production and inspection equipment;

(c) competent personnel;

(d) applicable regulatory and design documentation; and

(e) pertinent manufacturing process specifications.

561.06 *Reserved*

561.07 *Manual*

(1) The manual required to be established and maintained pursuant to subsection 561.07(1) of the CARs includes the following:

(a) a section reserved for ministerial approval and a certification statement signed by the accountable executive confirming that the manual and any incorporated documents identified therein reflect the certificate holder's means of ensuring compliance with Subpart 61 of Part V of the CARs and Standard 561, and instructing the staff to comply with the policies and procedures therein;

(b) the manufacturer's approval number as shown on the manufacturer certificate issued by the Minister under section 561.03 of the CARs or provision to record that number, including the following information:

(i) the legal name of the certificate holder and, where that name is not the name under which the organization does business, its registered trade name, and

(ii) the mailing address where different from the manufacturing site address;

(c) a table of contents;

(d) a means of identifying each page of the manual that has been submitted for approval, in the form of a list of effective pages, with each page numbered and either dated or marked with a revision number; alternatively, in the case of electronic manuals, an equivalent means of ensuring that the manual is complete and up to date;

(e) the process for issuance and control of amendments, including a description of the amendment distribution procedures and a reference to the list stating the title of each person who holds a copy of the manual, and the system used to ensure compliance with the requirements of subsection 561.07(8) of the CARs;

(f) a brief description of the organization including the approximate size, geographic location and basic layout of the facilities;

(g) a description of the scope of work that is intended to be performed at each facility;

(h) where management functions have been assigned pursuant to subsection 561.04(6) of the CARs:

(i) the name or title of any person to whom functions have been assigned,

(ii) a description of the functions that have been assigned to each person, and

(iii) where necessary for clarity, a chart depicting the distribution of functions;

(i) a description of the system to obtain and preserve pertinent regulatory, design and other technical data, and procedures to ensure they are kept up to date;

(j) a description of the controls used to ensure that the product conforms to its type design;

(k) a description of the methods for evaluating and controlling suppliers;

(l) a description of the methods used to identify and trace the aeronautical products during all stages of the manufacturing process and up to delivery of the product;

(m) a description of the production control system which includes the requirements set out in section 561.08 of this standard;

(n) a description of the quality audit system which includes methods of audit, identification and analysis of probable root cause and contributory causes of deficiencies identified in audit results, corrective action follow-up and record keeping;

(o) a description of the policies and procedures for:

(i) authorizing persons to sign statements of conformity,

(ii) identifying those persons,

(iii) identifying the product or range of products they are authorized to certify, and

(iv) controlling the stamp issued to each person, where applicable;

(p) a description of the policies and procedures to control inspection, measuring and test equipment traceable to applicable Canadian or international standards in accordance with section 561.08 of this standard;

(q) a description of the system for the identification and control of non-conforming products along with the determination of corrective actions to be taken in accordance with section 561.08 of this standard;

(r) a description of the training program required by section 561.11 of the CARs;

(s) a description of the methods used to establish and maintain personnel records required by section 561.12 of the CARs;

(t) a description of the methods used to establish and maintain product records required by section 561.14 of the CARs; and

(u) a description of the policies and procedures to control the collection, evaluation and reporting of defects, malfunctions and failure data pursuant to section 561.15 of the CARs.

(2) Where the holder of a manufacturer certificate also holds other approvals, or conducts activities other than those approved pursuant to Subpart 61 of Part V of the CARs, the documented procedures governing those activities may be contained in the manual required by section 561.07 of the CARs, provided the structure of the manual makes clear which parts are intended to meet Subpart 61 of Part V of the CARs and Standard 561, and which are not.

Information Notes:

(i) Subsection (2) addresses instances where the content of the manual, required by Subpart 61 of Part V of the CARs, will be identical to the content of the manuals required to support other certificates. However, certain material will be required specifically for Subpart 61. In these cases, the certificate holder may provide cross-references that list each manual's requirements with reference to where the requirements are met within his approved manuals to support other certificates. In the process of granting his approval under these circumstances, the Minister will indicate which parts of the manuals are approved and for what purpose,(i.e. under what part of the regulations the approval is being granted). It is in the certificate holder's interest to ensure that material specifically required to support one particular certificate is separately identified to distinguish it from material of common interest. Deficiencies in material not so identified will have a direct bearing on all approvals held.

(ii) In emergency situations, the provisions of subsection 561.07(4) of the CARs provide a means for authorizing the use of temporary alternative policies and procedures to comply with the manual. It provides a means of authorizing the manufacturer to conduct specific activities outside the applicable policies and procedures contained in the approved manual. This can occur for any number of reasons. However, authorization may be granted only where the certificate holder reasonably demonstrates that an equivalent level of safety is maintained.

561.08 *Production Control System*

The production control system required by section 561.08 of the CARs includes the following:

(a) process controls during the production stage to ensure that processes are performed under controlled conditions and include documented instruction, workmanship criteria, data, suitable equipment and competent personnel;

(b) inspection and testing procedures, including receiving, in-process through final inspection, testing and flight operations including production flight tests, to ensure that all manufacturing and inspection tasks have been completed as planned and documented. The system includes written instructions for product verification that:

(i) establish where, throughout the production process, inspections will be performed, including those required at suppliers' facilities,

(ii) identify the nature of the inspections to be performed, and

(iii) establish final inspection procedures for a completed product, including:

(A) in the case of an aircraft, flight operations including the flight test procedures and checklists, and

(B) in the case of an engine, variable pitch propeller or component, procedures to ensure that all required functional tests have been performed;

(c) a system to ensure that inspection, measuring and test equipment is calibrated prior to use or at the intervals recommended by the equipment manufacturer, and the calibration is traceable to applicable Canadian or internationally recognized primary standards;

(d) a system for the identification and control of non-conforming product along with the determination of corrective actions to be taken;

(e) a system to track and record inspection and test status of products as they progress through the manufacturing process and the identity of the persons who confirm product compliance at each stage; and

(f) a system of corrective action for systemic deficiencies found during audits conducted under section 561.09 of the CARs.

561.09 *Quality Assurance Program*

(1) The quality assurance program required by section 561.09 of the CARs is

(a) responsive to any changes within the organization that could affect compliance with the manual or the scope of privileges of the manufacturer certificate; and

(b) addresses the need for amendments resulting from such changes.

(2) In order to identify and address all functions controlled by the manual, the audit system employs sufficiently detailed audit checklists or equivalent methods, having regard to the complexity of the activities of the holder of a manufacturer certificate, and more specifically, the audit system includes the elements listed under subsection 561.09(3) of the CARs.

(3) The audits required under section 561.09 of the CARs may be conducted on a progressive or segmented basis, provided that the entire organizational system is verified within the applicable interval.

561.10 *Statement of Conformity*

(1) The system required to authorize persons to sign statement of conformity identifies the individuals by name, together with the product or range of products they are authorized to certify, and where a stamp is used, the stamp number assigned.

(2) Duly signed statements of conformity confirm that the products certified:

(a) were produced in accordance with the policies and procedures identified in the organization's Manual;

(b) conform to the applicable type design; and

(c) are in condition for safe operation, subject to any conditions identified on the statement of conformity.

(3) Statements of conformity consist of the following, or a similarly worded, statement:

"The [*reference to product*] identified above, except as otherwise specified in [*reference to any exceptions or remarks*] has been manufactured in conformity to approved design data and is in condition for safe operation".

Information Note:

The phrase "similarly worded statement" is intended to ensure that an error in wording will not invalidate the statement of conformity. It will also allow for manufacturers who produce aeronautical products under contract to foreign organizations operating under the rules of other countries with which Canada has agreements. This statement may be omitted on documents intended for internal use within the manufacturing organization if the manual includes procedures that indicate when a signature in a given block of a company document constitutes a statement of conformity pursuant to section 561.10 of the CARs.

(4) Statements of conformity include the identification of the signatory, the name of the manufacturer and manufacturing approval number.

(5) In the case of aeronautical products other than complete aircraft, the statement of conformity may be made on an Authorized Release Certificate completed in accordance with Appendix A.

(6) In the case of aircraft, the certification is based on a Statement of Conformity Document that meets the requirements set out in Appendix B.

Information Note:

Persons not directly employed by the approved manufacturer certificate holder may be authorized to sign a statement of conformity in accordance with section 561.10 of the CARs, provided the applicable policies and procedures are set out in the manual.

561.11 *Training Program*

(1) The training program required to be established and maintained pursuant to section 561.11 of the CARs includes the following:

(a) initial training to ensure that all persons authorized to perform or supervise the performance of functions under the Subpart are aware of their technical, administrative, and regulatory responsibilities;

(b) update training to ensure that these persons remain competent and are made aware of any change to their area of responsibility;

(c) additional training, where shown to be necessary by a finding made under the quality assurance program or required due to changes in the CARs, Standard 561, or company procedures; and

(d) provisions to ensure that persons authorized to sign statements of conformity have demonstrated an appropriate level of knowledge and experience and understand their responsibilities.

(2) Until such time as the quality assurance program required by section 561.09 of the CARs indicates that a different interval is appropriate, the initial cycle for update training is not to exceed three years.

561.12 *Reserved*

561.13 *Control of Suppliers*

Information Note:

Where the parts supplied are standard or commercial parts, the certificate holder's control may be limited to incoming inspection and test.

561.14 *Aeronautical Product Records*

(1) Each record required to be maintained for an aeronautical product pursuant to section 561.14 of the CARs includes records in respect of:

(a) activities applicable to production;

(b) inspection and testing performed to determine conformity;

(c) rework to correct non-conforming products;

(d) production ground and flight tests if applicable; and

(e) release certification.

(2) A record keeping system that relies upon hard copy records, includes provisions to ensure that they are kept in a secure location to prevent loss or deterioration.

(3) A record keeping system that relies upon electronic storage media, includes provisions to ensure that:

(a) entries are subject to approval by an authorized person prior to saving the record;

(b) the system provides that if changes to established records become necessary, they are made in such a manner that the reason for the change and the identity of the person making the change are also recorded, and the original information remains available;

(c) back up copies are made and kept in a secure location to prevent loss of data in the case of a system malfunction; and

(d) printed copies are made available to the Minister upon request.

561.15 & 561.16 ***Reserved***

Appendix A
Authorized Release Certificate
(amended 2008/12/30)

(refer to subsection 561.10(5) of this standard)

The Authorized Release Certificate described in this Appendix conforms to a standardized internationally recognized format for the release of both new and used (maintained) aeronautical products (herein also referred to as items or parts). When used to certify new parts, it provides a means for issuance of the statement of conformity required by CAR 561. When used to certify the maintenance of used parts, it forms a means for issuance of the maintenance release required by CAR 571.

Except where specifically provided in this document, these instructions relate only to the use of the Authorized Release Certificate to certify the airworthiness of new parts produced under CAR 561. For the requirements applicable to the certification of parts produced under the jurisdiction of other national authorities, refer to the applicable foreign regulations. For the release of used parts, attention is also drawn to Standard 571, which covers the use of the certificate as a maintenance release.

The Authorized Release Certificate (hereinafter referred to as "certificate") is not an official Transport Canada form, but rather a template that may be used by industry organizations for the development of their own certificates. Subject to the conditions outlined in this Appendix, organizations may design their own certificates from scratch, or copy the blank examples and modify them as necessary. Blank samples may also be downloaded from the Transport Canada web site, where they are available in both *.xls and *.pdf formats.

Purpose and Use

The primary purpose of the certificate is to declare the airworthiness of new aeronautical products.

The certificate may be used for items intended for export, as well as for domestic purposes. It is considered to be valid worldwide but its acceptance will be dependent upon any specific notified import conditions. When using the certificate to satisfy such notified conditions, compliance must be certified according to a bilateral agreement or other working arrangement. In such cases, the "approved design data" mentioned in this certificate means data approved by the civil aviation authority of the importing country. The certificate is not a delivery or shipping note.

While the Canadian version of the certificate is not an official Transport Canada form, it has been allocated the title "Form One" for harmonized international identification purposes. This title replaces the previous designation 24-0078.

Holders of Transport Canada approved manufacturer certificates may issue Authorized Release Certificates for new items produced under their own manufacturer certificate, including items produced by their suppliers that are subject to the manufacturer's Quality Assurance Program oversight. They may also issue certificates for previously certified items (i.e., items received with a prior Authorized Release Certificate issued by an appropriately

approved supplier) provided the component concerned is part of a higher assembly whose production is within the prime manufacturer certificate holder's scope of approval.

Complete aircraft are not to be released using the certificate.

The certificate does not constitute approval to install the item on a particular aircraft, engine, or propeller but helps the end user determine the item's airworthiness approval status.

A mixture of new and used items is not permitted on the same certificate.

A mixture of items certified in conformity with "approved data" and to "non-approved data" is not permitted on the same certificate.

General Format

The certificate must comply with the format shown in the following examples, including block numbers and the location of each block. The size of the blocks may vary to suit the individual application, but not to an extent that would make the certificate unrecognizable. The certificate must be in "landscape" format, but the overall size may be significantly increased or decreased so long as the certificate remains recognizable and legible. If in doubt consult with Transport Canada.

All printing must be clear and legible to permit easy reading.

The certificate may either be pre-printed or computer generated, but in either case the printing of lines and characters must be clear and legible. Pre-printed wording is permitted in accordance with the examples, but no other certification statements are permitted. The preprinted statements on the certificate must appear in either English or French. Bilingual or multilingual formats may be used, provided one of the languages is either English or French.

The details to be entered on the certificate may be either machine/computer printed or hand-written using block letters and must permit easy reading. Abbreviations should be restricted to a minimum.

The user/installer responsibility statements may be placed on the bottom margin or on the reverse side of the certificate. The space remaining on the reverse side of the certificate may be used by the originator for any additional information but must not include any certification statement.

Copies

The certificate must accompany the item(s) described and correlation must be established between the certificate and the item(s). A copy of the certificate must be retained by the organization that raised it. Where both the certificate format and the data are entirely computer generated, retention by means of a secure database is acceptable, provided it is possible to generate a hard copy on request.

There is no restriction on the number of copies of the certificate sent to the customer.

The certificate may be attached to the certified item directly, or may be placed in an envelope for protection and the envelope attached to the item.

Lost Certificate

A request for the replacement of a certificate declared lost must come from the owner of the item. A file copy of the original certificate should be provided to the owner.

The replacement certificate serves as a historical record and not as a statement of the item's current condition.

Errors on a Certificate

If an end user finds one or more errors on a certificate, they must identify them in writing to the originator. Originators may issue a corrected certificate provided they can verify and correct the errors. The corrected certificate must have a new tracking number, signature and date.

The corrected certificate must contain an original signature in block 13b and the current date the signature is appended in block 13e.

A request for a corrected certificate may be honoured without verification of the item's condition, but a corrected certificate is not a statement of current condition and should include an explanation in block 12, including a reference to the previous certificate. Both certificates should be retained according to the retention period applicable to the first certificate.

The corrected certificate serves as a historical record and not as a statement of the item's current condition.

Completed Certificate

Refer to Figure 2 for an example of an appropriately completed certificate. When filling in the certificate, all entries must be in either English or French, and either typed or clearly printed in block letters in permanent ink. All blocks must be completed. Inapplicable items must be either marked "N/A" or struck out.

Once completed, the Authorized Release Certificate becomes part of the technical record for the item to which it relates, and eventually will become part of the technical record of the next higher assembly on which that item is installed. The certificate is therefore subject to all the applicable regulations related to manufacturing and technical records.

Completion of Certificate by the Originator

Block 1 – Approving Civil Aviation Authority (CAA) /Country

Block 1 is reserved for the name and country of the Civil Aviation Authority under whose jurisdiction the certificate is issued. The entry "Transport Canada" satisfies both requirements and is the only entry that may be made in respect of items produced under CAR 561. This text may be pre-printed on blank certificates.

Block 2 - Title block – The title "AUTHORIZED RELEASE CERTIFICATE — FORM ONE" should be pre-printed on the blank certificate, so no further entry is required in this block.

Block 3 – Form Tracking Number

Enter the unique number established by the numbering system/procedure of the approved manufacturer identified in block 4; this may include alpha/numeric characters. The originating organization must establish a tracking system to correlate the certificates with information on the released parts.

Block 4 – Organization Name and Address

Enter the full name and address of the approved manufacturer releasing the item(s) covered by the certificate. Logos, etc., of the organization are permitted if they can be contained within the block. This information may be pre-printed on the blank certificates.

Block 5 – Work Order/Contract/Invoice

To facilitate traceability of the items, where applicable enter the customer's work order number, contract number, invoice number, or similar reference; if none of these are applicable, enter "N/A".

Block 6 – Item

The block is provided to permit easy cross-reference to other blocks, preventing ambiguity by the use of line item numbers. Block 6 must be completed where there is more than one line item and reference to the items is made in other blocks. Where necessary, it is permissible to add lightly ruled lines to aid in separating the information relating to each line number.

Block 7 – Description

Enter the name or description of the item. In the case of multiple items, enter the description for each item number listed in block 6. Preference should be given to the term used in the Instructions for Continued Airworthiness (Illustrated Parts Catalogue, Aircraft Maintenance Manual, Service Bulletin, etc).

Block 8 – Part Number

Enter the part number as it appears on the item (or tag/packaging). In the case of an engine or a propeller, the type designation may be used. In the case of multiple items, enter the description for each item number listed in block 6.

Block 9 – Quantity

State the quantity of each item. In the case of multiple items, enter the quantity of each item number listed in block 6.

Block 10 – Serial/Batch Number

If the item is required by the applicable design data to be identified with a serial number or equivalent identification, enter it in block 10. If no serial number or equivalent identification is applicable, a batch number or other equivalent unique identifying number may be entered. If no unique identifying number is available, enter "N/A". Manufacturing in-process control numbers are not final serial numbers, and need not be entered.

Block 11 – Status/Work

Enter either "NEW" or "PROTOTYPE".

Enter "NEW" for:

1. the production of a new item in conformity to the approved design data;

2. re-certification by the organization identified in block 4 of the original certificate following alteration or rectification work on an item, prior to its entry into service. Re-certification may be needed following incorporation of design changes, correction of defects, renewal of shelf life, etc. Details of the original release and the rectification work are to be entered in block 12;

3. re-certification by the organization identified in block 4, of the original certificate from "prototype" to "new", following approval of the applicable design data, provided that the design data in question has not changed from that to which the product originally conformed. An explanation must be entered in block 12; or

4. the examination of a previously released new item, prior to entry into service, to establish airworthiness or conformity to a customer-specified standard or specification. An explanation of the basis of release and details of the original release must be entered in block 12.

Enter "PROTOTYPE" for the manufacture of a new item that conforms to data that is not yet approved. An explanation must be entered in block12.

Block 12 – Remarks

Enter in this block, either directly or by reference to supporting documentation, any information necessary for the user or installer to determine the airworthiness of an item. If necessary, a separate sheet may be used and referenced in this block.

In particular, enter details of any outstanding work required on or before installation of the item. If the item has been made or configured solely in accordance with specifications approved by a foreign airworthiness authority, and for some reason does not comply with Canadian requirements, include a statement to that effect.

Include any other information necessary to enable the installer to determine the condition and conformity of the item. Each statement must be clearly identified as to which item in block 6 it relates. If there is no statement, state "None".

Some examples of conditions that would necessitate statements in block 12 are:

1. When the certificate is used for prototype purposes enter the following statement:

"NOT ELIGIBLE FOR INSTALLATION ON IN-SERVICE TYPE CERTIFICATED AIRCRAFT."

"THIS ITEM (THESE ITEMS) CONFORM(S) TO DATA THAT IS NOT APPROVED AT THE TIME OF RELEASE. SUBJECT TO APPROVAL OF THE DATA, THE ITEM(S) IS (ARE) IN CONDITION FOR SAFE OPERATION."

2. Re-certification of "PROTOTYPE" items to "NEW" once the applicable design data is approved. Enter the following statement:

"RE-CERTIFICATION OF ITEM(S) FROM "PROTOTYPE" TO "NEW": THIS DOCUMENT ONLY CERTIFIES THE APPROVAL OF THE DESIGN DATA TO WHICH THIS ITEM (THESE ITEMS) WERE MANUFACTURED. IT DOES NOT COVER ANY CHANGES TO CONFORMITY OR CONDITION AFTER ISSUANCE OF THE INITIAL AUTHORIZED RELEASE CERTIFICATE [Enter reference to original certificate]."

3. When a corrected certificate is issued replacing a certificate with error(s) enter the following statement:

"THIS CORRECTED CERTIFICATE REPLACES THE CERTIFICATE [Enter original number] DATED [Enter original issuance date] AND DOES NOT RECERTIFY CONFORMITY/CONDITION OR RELEASE TO SERVICE."

4. For TSO articles, state the applicable TSO.

5. Shelf life data.

6. Details of shortages or outstanding work.

7. When printing data from an electronic Authorized Release Certificate any data not appropriate in other blocks should be entered in this block.

Block 13a – Mark only one of the two boxes

1. Mark the "approved design data and are in a condition for safe operation" box if the item(s) were manufactured using approved design data and found to be in a condition for safe operation.

2. Mark the "non-approved design data specified in block 12" box if the item(s) were manufactured using applicable non-approved design data. Identify the applicable data in block 12.

3. Mixtures of items released against "approved" and "non-approved" design data are not permitted in the same certificate.

Block 13b - Signature

This space shall be completed with the signature of the authorized person. Only persons specifically authorized by the certificate holder in accordance with CAR 561 are permitted to sign this block. To aid recognition, a unique number identifying the authorized person may be added. Alternatives to a hand-written signature (such as a computer-generated signature facsimile) are only permitted when authorized by Transport Canada.

Signature in this block constitutes a statement of conformity pursuant to CAR 561.

Block 13c - Approved Organization Number

Enter the approved organization number that identifies the manufacturer certificate issued by the Minister.

Block 13d - Name

Enter the name of the person signing Block 13b, printed, typed, or written in a legible form.

Block 13e - Date

Enter the date on which block 13b is signed using the format dd/mmm/yyyy (dd = 2 digit day, mmm = first 3 letters of the month, yyyy = 4 digit year).

Blocks 14a through **14e**

These blocks are reserved for maintenance purposes and are not used for manufacturing release. Manufacturers should shade, darken, or otherwise mark this area on the pre-printed blank certificates, to preclude inadvertent or unauthorized use.

Bottom margin or **reverse side of certificate**

Place the following statement on the pre-printed blank certificates to notify end users that they are not relieved of their responsibilities concerning the installation and use of any item accompanied by the form:

Installer Responsibilities

"This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown."

Figure 1 - Authorized Release Certificate

<table>
<tr><td colspan="2">1 Approving Civil Aviation Authority/Country

Transport Canada</td><td colspan="3">2.
AUTHORIZED RELEASE CERTIFICATE
FORM ONE</td><td>3. Form Tracking No</td></tr>
<tr><td colspan="5">4 Organization Name and Address</td><td>5 Work Order/Contract/Invoice</td></tr>
<tr><td>6 Item</td><td>7 Description</td><td>8. Part No.</td><td>9. Qty.</td><td>10. Serial/Batch No.</td><td>11. Status/work</td></tr>
<tr><td colspan="6">12 Remarks</td></tr>
<tr><td colspan="3">13a. Certifies that the items identified above were manufactured in conformity to:

☐ approved design data and are in condition for safe operation

☐ non approved design data specified in block 12</td><td colspan="3">14a. ☐ CAR 571.10 Maintenance Release

☐ Other regulation specified in block 12

Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, has been performed in compliance with the Canadian Aviation Regulations.</td></tr>
<tr><td>13b Signature</td><td colspan="2">13c. Approved Organization Number</td><td colspan="2">14b. Signature</td><td>14c. Approved Organization Number</td></tr>
<tr><td>13d Name</td><td colspan="2">13e Date (dd/mmm/yyyy)</td><td colspan="2">14d. Name</td><td>14e. Date (dd/mmm/yyyy)</td></tr>
</table>

(Previously form 24-0078)

Important: See notes on reverse side

Installer Responsibilities

This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown.

Figure 2 - Example of completed Authorized Release Certificate

1. Approving Civil Aviation Authority/Country	2.	3. Form Tracking No.
Transport Canada	AUTHORIZED RELEASE CERTIFICATE FORM ONE	AP-100-25785

4. Organization Name and Address	5. Work Order/Contract/Invoice
Aero Products Inc. 123 Any St. Montreal, QC, Canada A1A 2Z2	BAE-100-9487-2007

6 Item	7. Description	8. Part No.	9. Qty.	10. Serial/Batch No.	11. Status/work
1	Strut	763956	1	API-6438	New
2	Strut	763956	1	API-6450	
3	Brackets	935007	10	API-9377456-572	

12. Remarks

Items 1 and 2: Struts de-pressurized for shipping. Must be refilled and charged prior to installation.

13a Certifies that the items identified above were manufactured in conformity to:	14a. ☐ CAR 571.10 Maintenance Release
☒ approved design data and are in condition for safe operation	☐ Other regulation specified in block 12
☐ non approved design data specified in block 12.	Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, has been performed in compliance with the *Canadian Aviation Regulations*.

13b. Signature	13c. Approved Organization Number	14b. Signature	14c. Approved Organization Number
M Bélanger QC 041	164-95	N/A	N/A
13d. Name	**13e. Date (dd/mmm/yyyy)**	**14d. Name**	**14e. Date (dd/mmm/yyyy)**
M. Bélanger	07-Feb-2009	N/A	N/A

(Previously form 24-0078)

Important: See notes on reverse side

Installer Responsibilities

This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown.

Appendix B
Sample Statement of Conformity

(*Refer to subsection 561.10(6) of this standard.*)

Instructions: *Print or type all entries*

1. Aircraft

Manufacturer: ______________________________

Model __________ Serial No. __________ Registration Mark __________

Type Certificate No. ______________________________

____

2. Engine(s)

	Make	Model	Serial No.	Type Certificate No.
1.	______	______	______	______
2.	______	______	______	______
3.	______	______	______	______
4.	______	______	______	______

3. Propeller(s)

	Make	Model	Serial No.	Type Certificate No.
1.	______	______	______	______
2.	______	______	______	______
3.	______	______	______	______
4.	______	______	______	______

4. Approved Modifications Embodied Subsequent to Type Certification

Drawing & Issue No. ______________________________

Description ______________________________ [ ] **or**

as per attached list ______________________________

____

5. Certification

I hereby certify that the aircraft described above, produced under Manufacturing Certificate Number __________, has been manufactured in conformity to approved design data, is in a condition for safe operation and was satisfactorily flight tested on __________.
(date)

Signed ______________________ **Date** ______________________

On Behalf of ______________________________

(Company Name)

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 566 - AIRCRAFT MAINTENANCE ENGINEER LICENSING & TRAINING

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa (Ontario)
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51-15/403-2008E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2008-2 (2008/12/30)	[illegible]	[illegible]
2009-2 (2009/12/01)	[illegible]	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

AIRWORTHINESS MANUAL CHAPTER 566 - AIRCRAFT MAINTENANCE ENGINEER LICENSING & TRAINING

Table of Contents

PART V - AIRWORTHINESS

AIRWORTHINESS MANUAL CHAPTER 566
AIRCRAFT MAINTENANCE ENGINEER
LICENSING & TRAINING

DIVISION I
AIRCRAFT MAINTENANCE ENGINEER (AME)
LICENSING GENERAL

(amended 1999/08/01)

566.01 ***Application***

The standards set out in this Division apply in respect of aircraft maintenance engineer (AME) licenses issued pursuant to CAR 403.03.

Information Note:
The requirements in respect of approved training organization (ATO) certificates, issued pursuant to CAR 403.08, are set out in Division II of this chapter.

566.02 ***General***

(1) CAR 571.11 specifies the persons who may sign a maintenance release. As a prerequisite for effecting a maintenance release in respect of maintenance performed on a transport category aeroplane or a turbine powered helicopter, the AME must have successfully completed an applicable approved or recognized course of maintenance training on the type of aircraft, engine, or system concerned, meeting the requirements peculiar to type courses as set out in section 566.18.
(amended 2008/12/30)

Information Notes:
(i) CAR 403.02 provides that no person shall exercise the privileges of an AME licence unless that person is the holder of such a licence.

(ii) In certain circumstances, persons who are not the holders of an AME licence may be permitted to issue a maintenance release as provided in CAR 571.11.

(2) A foreign aircraft type training course may be recognized by the Minister for the purposes of meeting the requirements of CAR 571.11 when the request for recognition is made by an individual applying for the initial issuance of an AME licence, provided the following conditions are met:
(amended 2008/12/30)

(a) the individual held a valid AME licence issued by a contracting state at the time the course was completed;
(amended 2008/12/30)

(b) the individual submits the request in writing along with the following documentation:
(amended 2008/12/30)

(i) a copy of their licence,

(ii) their course graduation certificate, and

(iii) a transcript of the training taken and a course curriculum (certified as accurate by the organization that provided the training).

(3) A foreign aircraft type training course may be recognized by the Minister for the purposes of meeting the requirements of CAR 571.11 when the request for recognition is made by an individual who was a permanent resident of a country other than Canada for no less than one year at the time the aircraft type training course was completed, provided the following conditions are met:
(amended 2008/12/30)

(a) the individual held a valid Canadian AME licence at the time the course was completed;
(amended 2008/12/30)

(b) the individual submits the request in writing along with the following documentation:
(amended 2008/12/30)

(i) documented proof of residency at time of course completion,

(ii) their course graduation certificate, and

(iii) a transcript of the training taken and a course curriculum (certified as accurate by the organization that provided the training).

(4) The Minister's recognition or non-recognition of the foreign aircraft type training course is confirmed in writing.
(amended 2008/12/30)

(5) Foreign aircraft type training courses given by a training organization approved by a civil aviation authority with which Canada has entered into a bilateral agreement or technical arrangement that provides for the recognition of aircraft type training is recognized by the Minister when successfully completed by the individual requesting such recognition.
(amended 2008/12/30)

566.03 *Issuance and Endorsement of an AME Licence*

(1) Applications shall be submitted on Form 24-0083, available upon request from any Transport Canada Center (TCC). All copies of the application form shall be submitted to the appropriate TCC. An application shall remain valid for 12 months from the date it is accepted by Transport Canada (TC).

(2) The application shall be accompanied by the applicable charge set forth in CAR 104, which is non-refundable.

(3) Supporting documents to the application, such as the applicant's personal log book or other original record of training and experience, shall either be original documents, or be certified as true copies of the originals by the holder of a valid AME licence or a Transport Canada Civil Aviation Safety Inspector (CASI). Documents may not be in abbreviated or

coded form and shall be in either English or French. Translation from other languages shall be the applicant's responsibility.

(4) Applicants shall include proof of age, training, knowledge, experience and skill as follows:

(a) **Age**

Prior to licence issue, the applicant shall have attained the age of 21 years. All applications submitted by mail shall be accompanied by proof of age as provided herein. Applicants appearing at the TCC in person may also be requested to provide proof of age where, in the opinion of the CASI responsible for handling the application, the applicant is not clearly over the age of 21. As proof of age, the following documents are acceptable:

(i) Canadian citizenship certificates;

(ii) birth or baptismal certificates;

(iii) passports; or

(iv) any Federal or provincial identifying document showing the applicant's birth date.

(v) where proof of age cannot be provided by means of a document referred to in any of subparagraphs (i) to (iv), a declaration of age may be accepted in lieu.

(b) **Training**

Except as provided in 566.07, an applicant shall successfully complete basic training applicable to the rating as indicated in Appendix A. As proof of training, the applicant shall provide a certificate of successful completion of an acceptable aircraft maintenance training course. Approved basic training is approved in accordance with Division II. Applicable training may have been obtained by means of distance learning courses or by correspondence courses. In the case of balloons, the applicant must provide a certificate from the applicable balloon manufacturer. Where the applicant is seeking experience credit for the training, the certificate shall be issued pursuant to CAR 403.08 Approved Training Organizations.

Information Note: *Information regarding basic training courses is contained in AN C002 and is also accessible at Transport Canada's Internet site, @ www.tc.gc.ca.*

(c) **Knowledge**

Transport Canada approved training courses include technical examinations on the subjects covered by the course. Applicants shall successfully complete all the applicable examinations for the subjects concerned, conducted by the ATO in accordance with its approved procedures. As proof, the applicants shall submit a certificate or letter, issued by the ATO, attesting to the successful completion of the examinations.
(amended 2003/09/01)

(d) **Experience**

(i) Applicants shall have acquired the applicable amount of total, specialty, and civil aviation maintenance experience set forth in Appendix A. As proof of experience, the applicants shall submit a personal log book or equivalent document signed by the

persons responsible for the maintenance release of the work items recorded. At the time of application, the applicants shall have acquired all but six months of the required total experience. Credit toward the total aviation maintenance experience requirement shall be granted for time spent in approved basic training, in the ratio of one month's credit for each 100 hours of training, up to a maximum of:

(A) 24 months for M or E rating applicants.

(B) 18 months for S rating applicants.

Therefore a graduate from an ATO with a curriculum of 1800 hours, would qualify for 18 months credit.

(ii) Experience requirements expressed in months are predicated upon full time employment of 1800 working hours per year. Applicants with part time experience acquired at a lower rate than this may convert their actual working hours to months at the rate of one month for each 150 working hours, but in no case can a higher rate of work be used to obtain more than one month's credit for each actual calendar month worked.

(iii) Maintenance of military aircraft, or parts intended for installation on military aircraft, may be counted toward the total and specialty experience requirements, but not toward the civil aviation experience requirement. Maintenance of ultra-light, advanced ultra-light, amateur built, or owner maintained aircraft, does not qualify for any experience credit.

(e) **Skill**

(i) Applicants shall have performed a representative selection of eligible maintenance tasks, over the full range of applicable systems and structures, those tasks being comprised of not less than 70 percent of the items listed in Appendix B that are applicable to the rating sought and to the aircraft, systems or components for which the experience is claimed.
(amended 2008/12/30)

(ii) Each maintenance task claimed shall have been:
(amended 2008/12/30)

(A) subject to a maintenance release pursuant to CAR 571.10, or an equivalent civil aviation maintenance certification under the rules of a contracting state; or
(amended 2008/12/30)

(B) in the case of a maintenance task claimed on a military aircraft, performed on an aircraft type (or variant of a type) for which a civilian type certificate has been issued.
(amended 2008/12/30)

(iii) Applicants who claim previous maintenance tasks on military aircraft in accordance with clause (ii)(B), are required to perform a representative selection of maintenance tasks on civil registered aircraft. The tasks shall comprise not less than 10 percent of the items listed in Appendix B that are applicable to the rating sought and the aircraft, systems or components for which the experience is claimed.
(amended 2008/12/30)

Each task claimed shall have been subject to a maintenance release pursuant to CAR 571.10, or an equivalent civil aviation maintenance certification under the rules of a contracting state.
(amended 2008/12/30)

(iv) Proof of having completed aircraft maintenance tasks shall take the form of a certification by the AME, or equivalent person who supervised the work. The certification statement shall include the date, aircraft type, registration mark, or component serial number as applicable, and confirm that the applicant is able to:

(A) identify the applicable standard for the task;

(B) select the proper tools;

(C) perform the work correctly without supervision; and

(D) complete the necessary documentation.

(v) Persons who sign for completion of maintenance tasks shall be responsible for the accuracy of statements made.

(5) **Regulatory requirements examination**

Following a review of the application, TC will return any original supporting documents to the applicants. If the application is found acceptable, the applicants will be authorized to attempt the Transport Canada regulatory requirements examination upon payment of the appropriate charge set forth in CAR 104. The examination must be successfully completed within 12 months after the date on which the application was accepted by TC. The passing grade for this examination is 70%.

Information Note:
To assist in preparing for the examination, applicants may refer to TP3043 Study and Reference Guide.

(6) **Re-examination**

Applicants who fail an examination on the first attempt will not be re-examined sooner than 30 days following the failure. Applicants who fail a second or subsequent attempt will not be reexamined sooner than six months following each failure.

(7) **Licence issuance**

Applicants who meet the requirements of this section will be issued an AME licence with the applicable rating(s).

Information Note: *It is in the interest of license holders to communicate changes to their address to TC, as this is necessary to ensure receipt of TC advisory material.*

(8) **Ratings**

(a) The scope of maintenance release privileges is indicated by rating designators entered on the licence, as follows:
(amended 2009/12/01)

(i) M1: Non-turbojet aircraft approved to Chapter 522, 523, 523-VLA, 527 and 549 of the *Airworthiness Manual* and equivalent standards (includes all airframe, engines, propellers, components, structures, and systems of those aircraft), and the aircraft listed in paragraph 566.03(8)(b);
(amended 2009/12/01)

(ii) M2: All aircraft not included in M1 (excluding balloons) (includes all airframes, engines, propellers, components, structures, and systems of those aircraft), and the aircraft listed in paragraph 566.03(8)(b);
(amended 2003/09/01)

(iii) E: Aircraft electronic systems. (includes communication, pulse, navigation, auto flight, flight path computation, instruments and the electrical elements of other aircraft systems, and any structural work directly associated with the maintenance of those systems);

(iv) S: Aircraft structures. (includes all airframe structures);

(v) Balloons

(b) Holders of either an M1 or M2 rated AME licence also have maintenance release privileges for all:
(amended 2003/09/01)

(i) turbine powered helicopters; and

(ii) SFAR 41C aeroplanes, including their associated variants and derivatives.

(9) **Additional ratings**.

An AME may apply for additional ratings by meeting the requirements specified in 566.03. Credit will be granted for any requirements that were met in qualifying for the currently held ratings.

Information Note:
Individuals who hold both an M1 and M2 rating will not be issued any additional ratings (e.g. E or S ratings), as those privileges are already held within the scope of the combined M1/M2 rating privileges.

(10) **Obsolete ratings**.

AMEs who held ratings under the preceding licence system, that have no direct equivalents, or for which no designators have been established in the new system, will have the ratings entered on their licence in plain text. Examples of this include Balloons, Propellers, and Dynamic Components.

(11) **Renewal**.

Licenses that have not expired may be renewed upon submission of an application form 24-0083, and payment of the appropriate charge set forth in CAR 104.

(12) **Reissue**.

(a) Holders of licenses that have been expired for less than one year will be issued with a new licence upon submission of an application form 24-0083 and payment of the appropriate charge set forth in CAR 104.

(b) Holders of licenses that have been expired for one year or more, will be issued with a new licence upon submission of an application form 24-0083, successful completion of the regulatory requirements examination, and payment of the appropriate charge set forth in CAR 104.

(13) **Mutilated, lost or destroyed licenses**.
A mutilated, lost, or destroyed AME licence will be replaced upon submission of application form 24-0083 and payment of the appropriate charge set forth in CAR 104. The following declaration shall be made:

I am the holder of AME licence number ___________. I declare that the said document has been mutilated/lost/destroyed* and I hereby apply for a replacement.

Dated _________ and Signed ________________

*State which.

566.04 *Validity Period*

Unless surrendered, suspended or canceled, an AME licence remains valid until the date indicated on the licence. Upon issue or renewal, the "valid to" date will be set at six years calculated after the applicant's last birthday, i.e. the birthday immediately preceding licence issue or renewal.

566.05 *Recency Requirements*

(1) No person shall exercise the privileges of an AME licence unless, within the preceding 24 months, they have successfully completed the regulatory requirements examination, or have, for at least six months:
(amended 2003/09/01)

(a) performed aircraft maintenance;

(b) supervised the performance of maintenance, either directly or in an executive capacity; or

(c) provided aviation maintenance instruction within an ATO, or an approved training program in an AMO or directly supervised the delivery of such instructions.

(2) An AME who attempts the regulatory requirements examination as required by subsection 566.05(1) and fails will not be entitled to renewal until the examination has been successfully completed.
(amended 2003/09/01)

Information Note: *If an AME fails the regulatory requirements examination, the licence is subject to suspension in accordance with subsection 7.1(1) of the* Aeronautics Act. *Once the licence is suspended, its privileges can no longer be exercised until the AME demonstrates*

competence by successfully completing the regulatory examination.
(amended 2003/09/01)

566.06 *Licence Credentials*
(amended 2003/09/01)

(1) Upon successful completion of the conditions for initial issuance of an AME licence, and upon submission of a photograph, taken within the preceding six months, an interim paper licence is issued to the AME licence applicant, pending the issue of the licence that supersedes any licence previously issued.
(amended 2003/09/01)

Information Note: *The issuance of the interim licence is a regional function. The licence, which is in the form of a credit card type and which bears the photograph of the applicant, is issued by Headquarters upon receipt of the pertinent documentation from the applicable Region and replaces the interim paper licence issued pursuant to subsection (1).*
(amended 2003/09/01)

(2) The licence referred to in subsection (1) has the same validity period as specified in section 566.04 of this Standard and bears the licence holder's photograph.
(amended 2003/09/01)

(3) When renewing an AME licence in accordance with subsections 566.03(11) or (12) of this Standard, the licence holder is required to submit a new photograph, taken within the preceding six months.
(amended 2003/09/01)

(4) Where the requirements of subsection (3) have been met, the licence holder is issued a licence, displaying the new photograph and validity period. The new licence supersedes any licence previously issued.
(amended 2003/09/01)

566.07 *Alternative Training Provisions*

(1) **Foreign Licences**

(a) Applicants who held, prior to 1 January 1990, a valid Inspection Authorization issued by the US Federal Aviation Administration, or a valid AME licence conforming to Annex 1 of the ICAO Convention, that included airframe and engine privileges, are exempt from the basic training requirement specified in Appendix A.
(amended 2008/12/30)

(b) Applicants who held, prior to 1 September 1985, a valid AME licence conforming to Annex 1 of the ICAO Convention, that included avionics privileges, are exempt from the basic training requirement specified in Appendix A.
(amended 2008/12/30)

(c) Applicants who held, prior to 1 September 2001, a valid AME licence conforming to Annex 1 of the ICAO Convention, that included structures privileges, are exempt from the

basic training requirement specified in Appendix A.
(amended 2008/12/30)

(d) Applicants who hold a valid AME licence, other than one of the types specified in (a), (b) or (c) will be assessed in accordance with subsection (2).
(amended 2008/12/30)

(e) All applicants, regardless of the type of foreign licence held, are required to successfully complete the Transport Canada examinations applicable to the rating sought, in accordance with subsection (2).
(amended 2008/12/30)

(2) **Other Basic Training**

(a) Applicants who obtained their basic training through training systems other than a Transport Canada ATO (i.e. foreign, military, self-paced, distance learning, etc.), or who successfully completed a Transport Canada ATO course but failed to meet the experience credit requirement, shall submit their graduation certificate, together with a transcript of the training received to the applicable Transport Canada Center (TCC) for assessment. The training received shall be assessed against the pertinent specifications of section 566.03 of this standard and the following standards:
(amended 2003/09/01)

(i) The applicant shall have received a minimum of 1000 hours theory training applicable to the AME licence "M & E" ratings or 550 hours theory training applicable to the AME licence "S" rating, in order to be considered as having acceptable basic training.
(amended 2003/09/01)

(ii) The theory training will be evaluated in accordance with the specifications of this standard set out in Division II, Subdivision B, and the applicable provisions of Appendix C. However, the theoretical basic training need not contain a CARs component.
(amended 2003/09/01)

Information Note*: The CARs component described in subparagraph 566.07(2)(a)(ii) is not required since successful completion of the regulatory requirements examination is required.*
(amended 2003/09/01)

(b) Once the evaluation is completed, TC will provide the applicant with feedback regarding basic training acceptability and an outline defining the scope of any additional training required, if any. Successful applicants will be required to complete the AME Licence Application Supplement, form 26-0638, for approval to attempt the TC technical examinations at a Transport Canada Centre. The technical examinations must be successfully completed within 12 months from the date on which the application was approved by TC.
(amended 2003/09/01)

(c) The passing grade for the TC technical examinations is 70%. An AME licence applicant who fails an examination on the first attempt shall not be re-examined sooner than 30 days following the failed attempt. An AME licence applicant who fails a second or subsequent attempt shall not be re-examined sooner than six months following each failed attempt.

Following successful completion of the TC technical examinations, the applicant may apply to TC for evaluation of their experience and skill in accordance with paragraphs 566.03(4)(d) and (e) of this Standard.
(amended 2003/09/01)

DIVISION II - APPROVED TRAINING ORGANIZATIONS

(amended 1999/12/01)

566.08 *Applicability*

The standards set out in this Division apply in respect of approved training organization (ATO) certificates issued pursuant to CAR 403.08. Courses which are eligible, pursuant to these standards, for the credit of technical examination or experience, shall be provided by the ATO in English or French.
(amended 2008/12/30)

Information Note: *This division comprises of: Subdivision A - General; Subdivision B - Basic Training; and Subdivision C - Type training.*

SUBDIVISION A - GENERAL

566.09 *Application for Approval*

(1) Initial application for approval of an ATO shall be made in writing, accompanied by two copies of a policy manual that meets the requirements of STD 566.10.

(2) The application shall be submitted to the TCC responsible for the area in which the training organization is located. In the case of organizations whose facilities are located outside Canada, the application shall be made to the Chief, AME Licensing and Training, Aircraft Maintenance & Manufacturing Branch.

Information Note: *The policy manual may be in either hard copy version or in an electronic version.*

566.10 *Policy Manual (PM)*

(1) The policy manual, also referred to as the training control manual, may be a stand-alone document, or may be contained in another manual, such as an air operator MCM or an approved maintenance organization MPM. The policy manual shall be detailed, organized in numerical order and structured in such a manner, as to form an easily accessible reference standard for day to day use and regulatory audit.

(2) The policy manual shall include the following elements:

(a) an Organizational Chart showing the responsibilities and reporting level of each faculty member. Where an individual reports to more than one manager, the chart shall clearly indicate which manager is responsible for which function. The duties, position qualifications and responsibilities of each of the reporting levels listed on the organizational chart shall be described.

(b) an Amendment System describing the amendment procedure to ensure that the PM in use reflects the latest approved amendment. It must include a means of identifying each page of the PM.

Information Note: *This may be in the form of a List of Effective Pages, with each page numbered and dated or marked with a revision number.*

(c) a Course Instructor Listing indicating the required number of instructors, licensed in aircraft maintenance or having experience in the applicable specialty in order to meet the curriculum delivery requirements of Subdivisions B and C of this division. The instructors must be trained in instructional techniques and in the applicable subject matter.

(d) a Professional Development Program that ensures up-dating of instructor knowledge and expertise on a continuing basis. The cycle for update training shall not exceed three years.

(e) an Advisory Committee System that shall include:

(i) a membership comprised of pertinent representatives of the aviation industry;

(ii) a description of the duties and responsibilities of the advisory committee;

(iii) a mandate to ensure that course performance objectives are current from an industry perspective, and to satisfy industry needs for appropriately trained technical personnel;

(iv) procedures to record minutes of meetings, and communicate the decisions reached to individuals or organizations involved with changes to the program (i.e. Transport Canada, provincial authorities and training organization officials); and

(v) procedures to document, in detail, how changes to course format and content are handled. This shall include, but will not be limited to, content, equipment, delivery and facilities.

Information Note: *While an advisory committee system is essential for basic training organizations and is part of the quality system, formally constituted advisory committees may not be required for type training organizations.*

(f) a Quality System that comprises of a quality loop conceptual model. It shall include a description of the methods used to control the:

(i) development of training, including lesson plans;

(ii) development of student assessment methods;

(iii) competency and currency of instructional staff;

(iv) presentation of course material to meet training objectives;

(v) method of gathering and analyzing feedback from the course;

(vi) method used to determine corrective action where necessary; and

(vii) method used to monitor the results of any corrective action taken.

Information Notes:

(i) The quality system should only be as comprehensive as needed to meet the quality objectives.

(ii)For contractual, mandatory and assessment purposes, demonstration of the implementation of identified elements in the system may be required.

(g) a Person Responsible for Training Section indicating who shall be responsible for ensuring the program integrity. The person appointed shall have a minimum of six years experience in the maintenance of aircraft, and a knowledge of maintenance training, development and delivery.

(h) a Course Prerequisites Section for student admission indicating which prerequisites are necessary in order to meet course delivery objectives.

(i) a Student Attendance Control System containing the following:

(i) Training schedules to ensure that students do not exceed eight hours of training (or combined duty/training) in any one day, or six days or forty hours of duty/training in any seven day period. The only exceptions to these requirements are in isolated situations where, due to equipment availability, students would otherwise miss an opportunity for access to specific equipment (e.g. simulator, aircraft).

(ii) A recording procedure to accurately document the student's attendance so that the individual's presence is recorded and controlled for each class, shop or laboratory activity. The following criteria shall apply:

(A) students having missed more than 5 percent of the course through absences, shall not qualify for experience credit from a basic training course;

Information Note:

While not qualifying for an approved course credit, students may still qualify as having completed an acceptable course in aircraft maintenance.

(B) students who have missed more than 5 percent of the course shall not graduate from a type training course;

(C) a student may make up the lost time which is in excess of 5 percent through documented supplementary studies, equivalent to that missed from the original program to qualify for experience credit. The Policy Manual shall contain details on how this may be achieved.

Information Note:

The 5 percent absence policy is intended for illness, bereavement, or other circumstances beyond the individuals control.

(j) examination methods which evaluate whether students have achieved the learning objectives of the training provided. Examination methods may include written, oral, practical, or electronic testing. Records shall be retained and made available to TC upon request. Examination development shall include policies:

(i) to ensure that the quantity or the weighted value of each examination is dependent upon the importance of the learned outcome, the frequency of occurrence, and the level of difficulty; and

(ii) that establish the validation by an independent subject matter expert of the validity, accuracy, clarity and appropriate weighting of the examinations.

Information Notes:

(i) The completed examinations should ensure that performance objectives have been met. The use of a test map or other devices should ensure that those subject areas with the greatest impact are tested to the highest level; while the subject areas, or tasks with the least impact are tested to the lowest level.

(ii) Independent subject matter experts may be chosen from either an external organization or from within the organization.

(k) an Examination Process Control to ensure that:

(i) new examination questions are developed if confidentiality becomes compromised;

(ii) all examination material and marking guides are maintained in a secure and confidential manner;

(iii) examinations are carried out in a controlled environment to protect the integrity of the evaluation process;

(iv) there is consistency of examination (usually specified in the course standard);

(v) post examination reviews are conducted and corrected to 100 percent;

(vi) versions and/or variances of the evaluation instruments used in the initial and rewrite evaluation process are secure;

(vii) the successful completion of examinations occur within 1 year following program completion;

(viii) examination methods intended to test the students theoretical knowledge are to be of the closed book variety, with a 70 percent or greater passing grade established for each major subject area; examination methods intended to test the students skills or abilities are of a practical nature and are to be graded by a "pass" or "fail" method; and (amended 2008/12/30)

(ix) limits are set for the maximum number of attempts permitted.

(l) a Record Keeping System ensuring that records are maintained and retained for a period of not less than 5 years. The records shall include:

(i) student attendance, performance and grades;

(ii) certificate issuance;

(iii) advisory committee meetings and minutes; and

(iv) instructor qualifications and professional development.

(m) a Certificate Issuance Control System ensuring that certificates are delivered to students who successfully complete an approved course. A sample of the certificate issued by the training organization, to indicate successful completion of a course, shall be included in the PM. The organization shall provide a current list of names and signatures of all individuals authorized to sign certificates, forms and letters to Transport Canada (TC). The certificate shall include the following:

(i) the name and location of the training organization;

(ii) the type or description of training accomplished;

(iii) the full name of the student;

(iv) the date of course completion;

(v) TC course approval number;

(vi) an embossed raised seal;

(vii) the signature of authorized officials; and

(viii) for type training, the course duration in hours, and aircraft, engine, airframe or systems identification.

(n) a Facilities Section describing the facilities and support systems for the type of delivery consistent with the scope of the program. This shall include adequate heating, lighting and ventilation to accommodate the maximum number of students expected to be taught at any one time. A floor plan of the primary facility shall be included showing the space allocation for the location of offices, classrooms, shops and any other space allocations. Where applicable, the ATO shall identify minimum facility standards for the conduct of courses at locations other than the prime facility.

(o) Training Material and Instructional Aids ensuring that:

(i) Students have access to a current technical library in a controlled environment to support program course objectives. In addition, the organization make available an adequate supply of materials, shop equipment, tools (including special tools) and any miscellaneous equipment used to support the training standard.

(ii) Facilities, classrooms, tools and equipment are appropriate for the purpose for which they are to be used and are kept in a functional condition to support the program. The training organization ensures the availability of any other equipment utilized within the organization or at external facilities to support their program.

Information Note:

This may be achieved through a letter of agreement from the supplying or contracting organization.

(iii) Each student has an equal and reasonable opportunity to actively participate in all learning objectives.

(p) a Training Material Evaluation Procedure ensuring that training material is sufficient and capable of supporting training objectives.

566.11 *Rating Bridging Programs*

Where an ATO engages in the delivery of bridging programs to address rating differences, the program must meet all applicable rating requirements identified in these standards.

Information Note:

Ratings are defined in Division I of these standards.

SUBDIVISION B - BASIC TRAINING

566.12 *Curriculum*

(1) In addition to the requirements of STD 566.10, an applicant must submit a curriculum to TC that meets the standards outlined in this subdivision. The curriculum shall contain elements that ensure graduating students are knowledgeable in all aspects of aircraft maintenance, inspection and regulatory subject matter.

Information Note:

The intent of the approved program is that graduates will be fully qualified maintenance technicians who, after obtaining the required practical experience and following successful completion of the TC regulatory requirements examination, will be prepared to assume the responsibilities and privileges of an AME license. The approved basic training curriculum guides are outlined in Appendix C in topic format.

(2) Alternate methods of compliance will be reviewed on an individual basis to ensure that the training organization meets these requirements. If alternate methods of compliance are possible, it must be indicated in the initial application.

(3) An approved maintenance or avionics program shall consist of not less than 1800 hours of subject matter training.

(4) An approved structures program shall consist of not less than 1000 hours of subject matter training.

(5) An organization capable of proving its ability to deliver the training in less than the prescribed hours, will be reviewed and approved by Transport Canada on an individual basis.

(6) In order to meet the basic training requirements identified in Division I, the following training standards have been developed. The items listed below relate to the training provided through an ATO. In this environment, the student who meets the criteria defined within the approved training manual of the organization will be eligible for an experience credit towards the AME licensing requirements.

Information Note:

With this in mind, the task-related items placed in this standard will assist with the development of the skills required, in accordance with paragraph 566.03(4)(e), to successfully complete the items listed in Appendix B of this standard. The items within Appendix B have been deemed by Transport Canada to be a sample of fundamental tasks required for completion by an AME candidate. These tasks will demonstrate adequate knowledge and skills in the procedures and processes required for the performance of aircraft maintenance. An

understanding of these concepts is required to make determinations relating to the inspection and certification for the purpose of Maintenance Release, regardless of the type of work.

(7) Should alternate forms of delivery be used outside an ATO where task related "hands on" training is not delivered, the organization must demonstrate compliance to all items within the training standard through a theoretical training format. This training will include the theoretical component associated with the performance of all tasks. No experience credit will be available in this situation.

566.13 *Training Standards Common to all Training Programs*

Upon graduation from all approved basic training programs, the student will be able to:

(a) **Apply:**

(i) Occupational Health And Safety practices.

(ii) the *Canadian Aviation Regulations* applicable to an AME.

(iii) acceptable industry standard practices.

(b) **Explain:**

(i) aircraft system operation to component level.

(ii) standard practices for operational checks, inspection and certification of aircraft systems.

(iii) procedures and applicable standards required for structural and non-structural repairs and modifications.

(iv) the effects of human factors contributing to maintenance errors.

(c) **Perform:**

(i) the installation and securing of fasteners and connectors.

(ii) an applicable sheet metal repair or modification.

(iii) to completion an applicable inspection for the purpose of certification.

(iv) a maintenance release including:

(A) technical records entries;

(B) certification forms;

(C) weight and balance reports, and

(D) other related documentation.

(v) tasks utilizing and interpreting technical information systems.

566.14 *Small Aircraft*

Upon graduation the student will be able to:

(a) **Explain:**

(i) the system logic and processes used to determine, develop and maintain the appropriate maintenance schedule.

(ii) the procedures used to inspect and test the operation of avionics and auto-flight systems representative of those installed in small aircraft.

(iii) types of non-destructive inspection procedures.

(b) **Perform:**

(i) servicing procedures on fixed and rotary wing aircraft.

(ii) tasks utilizing minimum equipment lists, configuration deviation lists, and built-in test equipment programs.

(iii) scheduled and unscheduled inspections.

(c) **Test, troubleshoot, repair, adjust, remove and replace:**

(i) power plants and related systems.

(ii) propeller and rotor systems.

(iii) airframe and related systems.

(iv) electrical systems.

(v) airframe structures.

(vi) dynamic components.

566.15 *Large Aircraft*

Upon graduation the student will be able to:

(a) **Explain:**

(i) the procedures used to inspect and test the operation of avionics and auto-flight systems representative of those installed in large aircraft.

(ii) the system logic and processes used to determine, develop and maintain the appropriate maintenance schedule.

(iii) types of non destructive inspection procedures.

(iv) fault diagnostic systems typical of those installed on large aircraft.

(v) mechanical and electronic systems including electrical/mechanical and digital control systems.

(b) **Perform:**

(i) servicing procedures on fixed and rotary wing aircraft.

(ii) tasks utilizing minimum equipment lists; configuration deviation lists; and built in test equipment programs.

(iii) scheduled and unscheduled inspections.

(c) **Test, troubleshoot, repair, adjust, remove and replace:**

(i) power plants and related systems.

(ii) propeller and rotor systems.

(iii) airframe and related systems.

(iv) electrical systems.

(v) airframe structures.

(vi) dynamic components.

566.16 *Electronics*

Upon graduation the student will be able to:

(a) **Explain:**

(i) the system logic and processes used to determine develop and maintain the appropriate maintenance schedule.

(ii) fault diagnostic systems typical of those installed on aircraft.

(iii) the procedures used in the repair and servicing of auto-flight systems.

(iv) mechanical and electronic systems including electrical/mechanical and digital control systems.

(b) **Perform:**

(i) tasks utilizing minimum equipment lists; configuration deviation lists; and built in test equipment programs.

(ii) installation of a navigation and communication system.

(c) **Test, troubleshoot, repair, adjust, remove and replace:**

(i) communication systems.

(ii) navigation systems.

(iii) electrical and lighting systems.

(iv) instrumentation systems.

(v) aircraft electrical and electronic integrated systems.

566.17 *Structures*

Upon graduation the student will be able to:

(a) **Perform:**

(i) effective corrosion control and repair for aircraft structures.

(ii) tasks utilizing the tools and equipment applicable to the maintenance of aircraft structures.

(iii) sealing procedures for aircraft structures.

(iv) tasks incorporating the correct selection and installation of fasteners used on aircraft structures.

(v) repairs and replacement of fabric coverings.

(vi) a repair scheme to meet the applicable standards.

(b) **Fabricate, assemble and repair:**

(i) sheet metal, tubular, composite; and wood structures.

(ii) fluid lines and conduits.

(c) **Assemble, install and repair:**

(i) transparencies including but not limited to windscreens, windows, lenses that form part of the aircraft structure.

SUBDIVISION C - TYPE TRAINING

566.18 *Training Outline*

(1) In addition to the requirements of STD 566.10, an applicant shall submit a training outline that meets the standard specified in this subdivision . The type course must contain elements that enable a graduating student to be knowledgeable in all aspects of aircraft maintenance including all major systems of the aircraft type, powerplant, avionics system or equipment being addressed. A type training ATO may be limited in scope, or include coverage of the full aircraft and its systems.

Information Note: *Following successful completion of the TC approved course, the technician will be fully knowledgeable regarding the characteristics of the applicable topic area, particular aircraft type or series.*

(2) The type training shall provide system description and details of operation, component location, servicing, removal and installation, and test procedures to support a typical maintenance schedule for the aircraft type or series.

(3) Upon graduation the student will be able to:

(a) **Apply:**

(i) applicable reference manuals.

(b) **Explain:**

(i) safety precautions to be observed when working on or near the aircraft and its systems.

(ii) locations of principal components.

(iii) normal functions of each major system, including terminology and nomenclature.

(iv) applicable system operations and maintenance practices.

(v) procedures for carrying out significant tasks associated with the routine servicing of the aircraft and its systems.

(c) Carry out functional checks applicable to system, engine, component as specified in the instructions for continuing airworthiness applicable to the aircraft, engine and related systems.

(d) Utilize the MEL/CDL in order to interpret reports provided by crew members and/or on-board reporting systems.

(e) Interpret readings and indications provided by BITE and other information systems.

(f) Analyze information for the purpose of making decisions in respect to fault diagnosis and rectification contained in the instructions for continuing airworthiness.

(4) The training organization shall have available for audit, detailed supporting documents, including:

(a) the allotted number of hours per subject;

(b) the course objectives indicating level of knowledge, competency and skill to be achieved by the student;

(c) practical projects to be completed; and

(d) a schedule of the examinations or tests to be given.

(5) A TC approved course shall have a system in place to ensure "hands-on" training is provided to support the training objectives. There shall be no less than 5 percent "hands-on" training in relation to the course duration.

(6) Support for practical training requirements must include a list of instructional aids and training material. This can be achieved with any combination of the following:

(a) a simulator or procedures trainer of a type compatible with or similar to the aircraft;

(b) an aircraft of the type; and/or

(c) training aid mock-ups, or computer simulation systems, or any other aids which support the intent, and are of equivalent training value when used as a substitute for actual aircraft or systems.

Information Note:

The purpose of the instructional aids is to ensure that students can identify and locate all aircraft systems and components, and are able to effectively carry out inspections and functional tests of live or simulated aircraft systems.

(7) Training material and instructional aids, which must be available to the student, include student handout material and instructional guides that are to be included in the course curriculum or training standard.

Information Notes:

(i) Type courses delivered by approved maintenance organizations (AMOs), to support the issuance of aircraft maintenance certification authority (ACA) privileges to their own

employees, are approved as part of the AMO approval process and do not require a separate ATO approval. However, if the AMO intends to provide aircraft type training to technicians/AMEs of other organizations, then an ATO approval is required.

(ii) Before AMEs can exercise aircraft certification privileges within an Aircraft AMO, they must be granted ACA privileges as required by CAR 573.05. This authority will be dependent upon completion of training specified in the policy and procedures section of the AMO's policy manual.

(8) An applicant may under special circumstances request authorization for a one-time delivery of a type course (per aircraft type). For this one-off course delivery, a formal PM may not be required, however, supporting documentation must be submitted indicating the methods of compliance specified in this subsection prior to obtaining TC approval. Subsequent courses must conform to all the applicable requirements specified in this Division.

Information Note:

The one-off courses will receive a distinctive TC approval number and a listing of these courses will be published in AN C003, and at the TC web site.

(9) Where an organization is engaged in the delivery of aircraft type differences training, the difference type course prerequisites must be such that only individuals who have successfully completed an initial type course in the particular aircraft series can be considered as acceptable candidates for differences training. All subject matter of the initial aircraft type course(s), must be considered, when evaluating differences subject matter for the applicable comparative or derivative type aircraft.

(10) Procedure for recognizing type training courses:
(amended 2008/12/30)

(a) Applicants that have completed unapproved type training from an ATO or from an organization that is currently undergoing the ATO approval process may request to have the course recognized.
(amended 2008/12/30)

(b) Applicants are required to submit their graduation certificate and a transcript of the training or curriculum for evaluation. If found acceptable, the Minister confirms in writing that the type training course is recognized.
(amended 2008/12/30)

(c) where the Minister has identified significant training deficiencies in the course, the applicant is advised of the subject matter and topic areas where additional approved training is required.
(amended 2008/12/30)

Appendix A
Table Of Requirements

1. The following table summarizes the requirements for each AME license rating. This table shall be applied together with the requirements specified in this standard. To use the table, first refer to the rating requested, then read across horizontally, to identify training, experience, and examination requirements.

2. Experience requirements are given in months. Each column specifies a different type of experience, and the applicant will be assessed separately against each one.

Note: *The same time period may be applied to more than one column.*

3. In columns 4, 5, and 6 of this table, the following descriptions of the various types of aviation maintenance experience shall apply:

(a) "Total" refers to experience in the maintenance of aeronautical products, including aircraft, engines, propellers, components, systems and structures.

(b) "Specialty" refers to experience in the maintenance of aeronautical products of the kind defined in the scope of privileges for the rating. It must cover the full range of the specialty, which in the case of M1 and M2, includes on-aircraft maintenance of the entire aircraft, including its engines, propellers, components, systems and structures.

(c) "Civil" refers to experience in the maintenance of civil registered aircraft, or parts thereof, that is subject to a maintenance release pursuant to CAR 605.85, or an equivalent certification under the rules of a contracting state.

Table of Requirements

Rating	Scope of privileges	Basic training	Aviation Maintenance Experience			Technical Examinations[7]	Regulatory requirements exam
			Total[1]	Specialty[2]	Civil		
M1	Small aircraft[3]	Yes	48 Month[4]	12 Month	6 Month	Yes	Yes
M2	Large aircraft[3]	Yes	48 Month	12 Month	6 Month	Yes	Yes
E	Electronics	Yes	48 Month	12 Month	6 Month	Yes	Yes
S	Structures	Yes	36 Months	24 Month	6 Month	Yes	Yes
B	Balloons	Yes[5]	120 hr.	120 hr.	120 hr.	Not required	Yes[6]
							(amended 2008/12/30)

[1] Total experience may be reduced by one month for each 100 hours of approved basic training, up to a maximum of 50 percent of the total experience requirement for the rating. This does not apply to the balloon rating.

[2] Specialty and civil aviation experience are required elements of the total aviation maintenance experience requirement (e.g. M1 requires a total of 48 months experience, 12 of which must be on small aircraft, and 6 must be in civil aviation). No training credit is applicable to these experience requirements.

[3] For ease of reference, the M1 and M2 ratings have been identified as small and large aircraft. Actual definitions for all ratings are specified in 566.03(8).

[4] Maintenance of ultra-light, advanced ultra-light, amateur-built, or owner maintained aircraft, does not qualify for experience credit.

[5] The basic training for balloon applicants consists of an acceptable course in balloon maintenance.

[6] The regulatory examination balloons consists of a subset of the standard regulatory requirements examination.

[7] Applicants whose basic training has been completed in accordance with the requirements of paragraph 566.03(4)(c) are recognized as having met the technical examination requirements for the type of training completed.
(amended 2008/12/30)

Technical Examinations
(amended 2008/12/30)

Rating	Examination code	Description
M1/M2	SPM	Standard Practices M Rating
	AP	Airframe (fixed and rotary wing)
	PP	Power Plant (includes propeller)
E	SPE	Standard Practices E Rating
	AV	Avionics (all systems)
S	SPS	Standard Practices S Rating
	ST	Structures (all structures)
B	*Information Note: There are currently no Transport Canada Technical Exams applicable to the Balloon Rating*	
		(amended 2008/12/30)

Appendix B - Part 1
Aircraft Maintenance Experience Sample Tasks (by Air Transport Association (ATA) Specification 100 Chapter Code)

M, E and S Ratings

These sample tasks represent a cross section of experience which apply to M-1, M-2, E and S ratings.

Some tasks apply to each rating, while others are clearly exclusive to one. Licensing applicants should review the list for applicability to the type of aircraft on which they are logging experience. In most instances, the list emulates that which is contained in the TC AME Personal Logbook.

Once a task has been completed it should be entered and certified as specified in 566.03.

ATA: 05 (Time limits & Maintenance checks)

100 hour check (general aviation aircraft).

"B" or "C" check (transport category aircraft).

Review records for compliance with airworthiness directives.

Review records for compliance with component life limits.

Inspection following heavy landing.

Inspection following lightning strike.

ATA: 06 (Dimensions/areas)

Locate component(s) by station number.

Perform symmetry check.

ATA: 07 (Lifting and shoring)

Jack aircraft nose or tail wheel.

Jack complete aircraft.

Sling or trestle major component.

ATA: 08 (Leveling/weighing)

Level aircraft.

Weigh aircraft.

Prepare weight and balance amendment.

Check aircraft against equipment list.

ATA: 09 (Towing and taxiing)

Tow aircraft.

Taxi aircraft.

ATA: 10 (Parking and mooring)

Tie down aircraft.

Park, secure and cover aircraft.

Position aircraft in dock.

Secure rotor blades.

ATA: 11 (Placards and markings)

Check aircraft for correct placards.

Check aircraft for correct markings.

ATA: 12 (Servicing)

Refuel aircraft.

Defuel aircraft.

Check tire pressures.

Check oil level.

Check hydraulic fluid level.

Check accumulator pressure.

Charge pneumatic system.

Grease aircraft.

Connect ground power.

Service toilet/water system.

Perform pre-flight check.

ATA: 18 (Vibration and Noise Analysis)

Analyze helicopter vibration problem.

Analyze noise spectrum.

ATA: 21 (Air conditioning)

Replenish vapour system.

Replace combustion heater.

Replace outflow valve.

Replace vapour cycle unit.

Replace air cycle unit.

Replace cabin blower.

Replace heat exchanger.

Replace pressurization controller.

Clean outflow valves.

Check operation of air conditioning/heating system.

Check operation of pressurization system.

Troubleshoot faulty system.

ATA: 22 (Auto flight)

Install servos.

Rig bridle cables.

Replace controller.

Replace amplifier.

Check operation of auto-pilot.

Check operation of auto-throttle.

Check operation of yaw damper.

Check and adjust servo clutch.

Perform autopilot gain adjustments.

Perform mach trim functional check.

Troubleshoot faulty system.

ATA: 23 (Communications)

Replace VHF com unit.

Replace HF com unit.

Replace existing antenna.

Install new antenna

Replace static discharge wicks.

Check operation of radios.

Perform antenna check.

Perform selcal operational check.

Perform operational check of passenger address system.

Functionally check audio integrating system.

Repair co-axial cable.

Troubleshoot faulty system.

ATA: 24 (Electrical Power)

Charge lead/acid battery.

Charge ni-cad battery.

Check battery capacity.

Replace cells.

Deep cycle ni-cad battery.

Replace generator.

Replace switches.

Replace circuit breakers.

Adjust voltage regulator.

Amend electrical load analysis report.

Repair / replace electrical feeder cable.

Troubleshoot faulty system.

ATA: 25 (Equipment/Furnishings)

Replace carpets.

Replace crew seats.

Replace passenger seats.

Check inertia reels.

Check seats/belts for security.

Check emergency equipment.

Check ELT for compliance with regulations

Repair toilet waste container.

Repair upholstery.

Change cabin configuration.

ATA: 26 (Fire protection)

Check fire bottle contents.

Check operation of warning system.

Check cabin fire extinguisher contents.

Check lavatory smoke detector system.

Install new fire bottle.

Replace fire bottle squib.

Troubleshoot faulty system.

ATA: 27 (Flight Controls)

Replace horizontal stabilizer.

Replace elevator.

Replace aileron.

Replace rudder.

Replace trim tabs.

Install control cable and fittings.

Replace flaps.

Replace powered flying control unit.

Replace flap actuator.

Adjust trim tab.

Adjust control cable tension.

Check control range and sense of movement.

Check for correct assembly and locking.

Troubleshoot faulty system.

ATA: 28 (Fuel)

Replace booster pump.

Replace fuel selector.

Replace fuel tank cells.

Check filters.

Flow check system.

Check calibration of fuel quantity gauges.

Check operation feed/selectors.

Troubleshoot faulty system.

ATA: 29 (Hydraulics)

Replace engine driven pump.

Replace standby pump.

Replace accumulator.

Check operation of shut off valve.

Check filters.

Check indicating systems.

Perform functional checks.

Troubleshoot faulty system.

ATA: 30 (Ice and rain protection)

Replace fluid tank.

Replace pump.

Replace timer.

Replace distributor.

Install wiper motor.

Repair de-icing boot.

Adjust brush block.

Check operation of systems.

Troubleshoot faulty system.

ATA: 31 (Indicating/Recording Systems)

Replace flight data recorder.

Replace cockpit voice recorder.

Replace clock.

Replace panel vibrator.

Replace master caution unit.

Perform FDR calibration/correlation check.

Perform FDR data retrieval.

Troubleshoot faulty system.

ATA: 32 (Landing Gear)

Build up wheel.

Replace main wheel.

Replace nose wheel.

Replace shimmy damper.

Rig nose wheel steering.

Replace shock strut seals.

Replace brake unit.

Replace brake control valve.

Bleed brakes.

Test anti skid unit.

Test gear retraction.

Change bungees.

Install floats.

Install skis.

Adjust micro switches.

Charge struts.

Troubleshoot faulty system.

ATA: 33 (Lights)

Repairlreplace rotating beacon.

Repair/replace landing lights.

Repairlreplace navigation lights.

Repairlreplace interior lights.

Repair replace emergency lighting system.

Perform emergency lighting system checks.

Troubleshoot faulty system.

ATA: 34 (Navigation)

Calibrate magnetic direction indicator.

Replace airspeed indicator.

Replace altimeter.

Replace air data computer.

Replace VOR unit.

Replace ADI.

Replace HSI.

Check pitot static system for leaks.

Check operation of directional gym.

Functional check weather radar.

Functional check doppler.

Functional check TCAS.

Functional check DME.

Functional check ATC Transponder.

Functional check flight director system.

Functional check Inertial nav system.

Complete quadrantal error correction of ADF system.

Update flight management system data base.

Check calibration of altimeter system.

Check calibration of pressure altitude reporting system.

Troubleshoot faulty system.

ATA: 35 (Oxygen)

Inspect on board oxygen equipment.

Purge and recharge oxygen system.

Replace regulator.

Replace oxygen generator.

Test crew oxygen system.

Perform auto oxygen system deployment check.

Troubleshoot faulty system.

ATA: 36 (Pneumatic systems)

Replace filter.

Replace compressor.

Recharge dessicator.

Adjust regulator.

Check for leaks.

Troubleshoot faulty system.

ATA: 37 (Vacuum systems)

Replace vacuum pump.

Check/replace fillers.

Adjust regulator.

Troubleshoot faulty system.

ATA: 38 (Water/Waste)

Replace water pump.

Replace faucet

Replace toilet pump.

Troubleshoot faulty system.

ATA: 45 (Central Maintenance System)

Retrieve data from CMU.

Replace CMU.

Perform Bite check.

Troubleshoot faulty system.

ATA: 49 (Airborne Auxiliary power)

Install APU.

Inspect hot section.

Troubleshoot faulty system.

ATA: 51 (Structures)

Sheet metal repair.

Composite repair.

Wooden repair.

Fabric repair.

Recover fabric control surface.

Treat corrosion.

Apply protective treatment.

Specific Tasks Associated With The S Rating

Corrosion Control

Ream and treat aluminum alloy corrosion

Remove and treat steel alloy corrosion

Remove and treat magnesium alloy corrosion

Prepare metal surfaces by shot peening

Perform removal and treatment of galvanic corrosion

Corrosion Assessment

Perform inspection of aircraft structure for corrosion

Perform removal of affected corroded areas by chemical/mechanical methods

Perform measurement of corrosion damage

Perform test of metal composites for corrosion

Perform non-destructive testing (NDT) inspection and interpret results

Aircraft Drawings

Interpret information from blueprints

Sealing

Prepare metal/wood/composite surfaces for sealing

Select/mix and apply sealants to seams, joints and fasteners

Fastener Installation

Identify fasteners and prepare lay out pattern

Drill, ream and countersink holes.

Identify solid rivet types.

Perform heat treatment of rivets.

Perform rivet installation (set and buck).

Perform installation of special fasteners/swage threadless collars.

Perform installation of panel and cowl fasteners.

Perform installation of blind bolts/nuts/rivets/rivnuts.

Perform installation of threaded fasteners/self and non-self locking fasteners.

Remove and install heli-coil.

Structural Damage Assessment

Perform visual inspection of damaged area.

Interpret NDI results.

Draw sketch of damaged area and determine required repair.

Aircraft Structure and Designs

Remove, install and align wing assembly after repair.

Remove, repair, balance install and rig flight surfaces.

Perform a weld repair to tubular structure.

Perform sheet metal repair to monocoque/semi-monocoque fuselages.

Engine and Mounting

Perform a weld repair to an engine mount.

Metallurgy and Heat Treatment of Metals

Perform heat treatment of ferrous/non ferrous metals.

Perform hardness testing of ferrous/and non ferrous metals.

Assembly

Install and align parts using jigs/holding fixtures.

Install parts maintaining tolerances.

Install, trim and fit parts.

Perform drilling, reaming and countersinking of holes.

Remove, disassemble/reassemble and install components and parts to gain access to a sheet metal repair.

Perform dressing and deburring of repaired area.

Apply of corrosion protection.

Apply of required sealants.

Perform bonding /spot weld parts.

Assemble parts using structural fasteners.

Remove/fabricate/install and safety flight control cables.

Remove old sealant and prepare and apply sealant to “wet wing” fuel tank, and pressure test tank for leaks.

Remove, repair and installation of wing leading edge/vertical/horizontal stabilizer surfaces after hail/bird strike damage.

Remove, prepare and install de-icing boots to wing leading edge/vertical/horizontal stabilizer surfaces.

Remove, prepare and install propeller de-icing boots.

Landing Gear

Repair main/nose landing gear doors

Repair to skis/floats

Sheet Metal Structures

Remove, repair/replace damage parts.

Reinforce/splice/replace structural sheet metal parts.

Reinforce/splice/replace forgings and extrusions.

Remove and replace rod-end fittings.

Repair non-structural cabin interior lining.

Perform stop drilling of small cracks in sheet metal parts.

Prepare and install patch to sheet metal skins.

Sheet Metal Fabrication

Read and interpret technical drawings.

Perform layout patterns/templates.

Perform cutting of material to size.

Form sheet metal with hand/machine tools.

Perform cold-working of fastener holes.

Perform sawing and routing of sheet metal.

Perform stop drilling of small cracks in sheet metal.

Perform fastening of sheet metal with rivets.

Perform fastening of sheet metal using bonding process.

Perform punch and drilling of sheet metal.

Perform dimpling and countersinking of sheet metal.

Composite Structures - Composite Repairs

Perform sanding/grinding/routing of damaged area.

Prepare damaged area by step/taper sanding.

Perform fabrication of pattern for cutting cloth patches.

Perform wetting-out of fabric with resin and cut out patches.

Perform a lay-up repair ply/plies using wet/pre-preg cloth.

Perform curing of repairs at room temperature.

Perform curing of repairs with heat blankets/oven.

Perform check for delamination.

Perform installation of inserts.

Perform sanding/priming and painting of repaired surface.

Composite Fabrication

Perform fabrication of master model.

Perform removal of mould from master model.

Perform fabrication of cutting pattern for lay-up plies.

Prepare plies for wet/pre-preg lay-up.

Prepare mould surface.

Perform curing of lay-up with heat blanket/oven/autoclave/room temperature.

Perform check for improper bonding.

Perform trimming of excess from parts/structure being fabricated.

Perform sanding/priming /painting of fabricated parts.

Fabric and Wood Repair

Perform fabric tests.

Perform repair to fabric covering.

Perform recovering of aircraft fabric surfaces.

Perform application of dope to aircraft fabric surfaces.

Perform application of paint to recovered fabric surfaces.

Wood Structures

Perform inspection of wood structures.

Perform selection of aircraft grade wood.

Perform repair/replacement to aircraft wood structure.

Perform sealing and refinishing to an aircraft wood structure.

Perform lamination of fabric to an aircraft wood structure.

Perform application of varnish to an aircraft wood structure.

Fluid lines and Conduits

Perform bending of tubing as per drawings/sample.

Perform fabrication of flexible hoses and leak test.

Perform fabrication of conduits and manifolds.

Windows

Perform inspection of aircraft windows

Remove and install cockpit windshield/sliding windows/side windows.

Perform buffing/polishing of windows.

ATA: 52 (Doors)

Rig/adjust locking mechanism.

Adjust air stair system.

Check operation of emergency exits.

Test door warning system.

Troubleshoot faulty system.

ATA: 56 (Windows)

Replace windshield.

Replace window.

Repair transparency.

ATA: 57 (Wings)

Skin repair.

Recover fabric wing.

Replace tip.

Replace rib.

Check incidence/rig.

ATA: 61 (Propeller)

Assemble prop after transportation.

Replace propeller.

Replace governor.

Adjust governor.

Perform static functional checks.

Check operation during ground run.

Check track.

Check setting of micro switches.

Dress out blade damage.

Dynamically balance prop.

Overhaul governor.

Overhaul prop.

Troubleshoot faulty system.

ATA: 62 (Main Rotors)

Install rotor assembly.

Replace blades.

Replace damper assembly.

Check track.

Check static balance.

Check dynamic balance.

Troubleshoot.

ATA: 63 (Rotor Drive)

Replace mast.

Replace drive coupling.

Replace clutch/freewheel unit.

Replace drive belt.

Install main gearbox.

Overhaul main gearbox.

Check gearbox chip detectors.

ATA: 64 (Tail Rotors)

Install rotor assembly.

Replace blades.

Troubleshoot.

ATA: 65 (Tail Rotor Drive)

Replace bevel gearbox.

Replace universal joints.

Overhaul bevel gearbox.

Install drive assembly.

Check chip detectors.

ATA: 67 (Rotorcraft flight controls)

Install swash plate.

Install mixing box.

Adjust pitch links.

Rig collective system.

Rig cyclic system.

Rig anti-torque system.

Check controls for assembly and locking.

Check controls for operation and sense.

Troubleshoot faulty system.

ATA: 71 (Power Plant)

Build up ECU.

Replace engine.

Replace scat hose.

Repair cooling baffles.

Repair cowling.

Adjust cowl flaps.

Repair faulty wiring.

Troubleshoot.

ATA: 72 (Piston Engines)

Remove/install reduction gear.

Overhaul engine.

Top overhaul.

Check crankshaft run-out.

Check tappet clearance.

Check compression.

Extract broken stud.

Install helicoil

Perform ground run.

Establish/check reference RPM.

Troubleshoot.

ATA: 72 (Turbine Engines)

Replace module.

Hot section inspection.

Engine ground run.

Establish reference power

Trend monitoring/gas path analysis.

Troubleshoot.

ATA: 73 (Fuel and control, piston)

Replace engine driven pump.

Adjust AMC.

Adjust ABC.

install carburetor/injector.

Adjust carburetor/injector.

Clean injector nozzles.

Replace primer line.

Check carburetor float setting.

Troubleshoot faulty system.

ATA: 73 (Fuel and control, turbine)

Replace FCU.

Replace engine driven pump.

Cleanltest fuel nozzles.

Clean/replace fitters.

Adjust FCU.

Troubleshoot faulty system.

ATA: 74 (Ignition systems, piston)

Change magneto.

Change ignition vibrator.

Change plugs.

Test plugs.

Check H.T. leads.

Install new leads.

Check timing.

Check system bonding.

Troubleshoot faulty system.

ATA: 74 (Ignition systems, turbine)

Check glow plugs/ignitors.

Check H.T. leads

Check ignition unit.

Replace ignition unit.

Troubleshoot faulty system.

ATA: 76 (Engine Controls)

Rig thrust lever.

Rig RPM control.

Rig mixture HP cock lever.

Rig power lever.

Check control sync (multi-eng).

Check controls for correct assembly and locking.

Check controls for range and sense of operation.

Adjust pedestal micro-switches.

Troubleshoot faulty system.

ATA: 77 (Engine Indicating)

Replace engine instrument(s).

Replace oil temperature bulb.

Replace thermocouples.

Check calibration.

Troubleshoot faulty system.

ATA: 78 (Exhaust, piston)

Replace exhaust gasket.

Inspect welded repair.

Pressure check cabin heater muff.

Troubleshoot faulty system.

ATA: 78 (Exhaust, turbine)

Change jetpipe.

Change shroud assembly.

Install trimmers.

ATA: 79 (Oil)

Change oil.

Check filter(s).

Adjust pressure relief valve.

Replace oil tank.

Replace oil pump.

Replace oil cooler.

Replace firewall shut off valve.

Perform oil dilution.

Troubleshoot faulty system.

ATA: 80 (Starting)

Replace starter.

Replace start relay.

Replace start control valve.

Check cranking speed.

Troubleshoot faulty system.

ATA: 81 (Turbines, piston engines)

Replace PRT

Replace turbo-blower.

Replace heat shields.

Replace waste gate.

Adjust density controller.

ATA: 82 (Engine water Injection)

Replace water/methanol pump.

Flow check waterImeth system.

Adjust water I meth. control unit.

Check fluid for quality.

Troubleshoot faulty system.

ATA: 83 (Accessory gear boxes)

Replace gearbox

Replace drive shaft

Check chip detector.

Appendix B - Part 2
Hot Air Balloon Maintenance Task List

These sample tasks represent a cross section of experience which apply to the balloon rating. Licensing applicants should review the list for applicability to the type of balloons on which they are logging experience. Once a task has been completed it should be entered and certified as specified in section 566.03.

Envelope

Inspect the envelope identification plate, confirm its security and the accuracy of the information.

Inspect the fabric gore by gore for defects, e.g. holes, stitching, tears or abrasions, mold, melt or mildew damage.

Inspect and check the fabric porosity.

Perform fabric strength check with a 1 inch grab test, inspect for signs of overheating.

Load Tapes

Inspect the horizontal and vertical load tapes and check for damage.

Perform check of the load tape base rigging points (chafing or heat damage).

Parachute

Inspect the Crown Ring for abrasion or burrs.

Inspect the parachute, panel by panel, and all connecting lines.

Inspect the Free Load Tapes/Spider Web for abrasion, stitching condition, and integrity.

Inspect the rip line (red line) for wear, correct length, burn damage and knots.

Inspect the velcro tabs and spring top locks (if applicable) for strength and integrity.

Inspect the valve lines for length, burn damage, pulley attachment and correct operation.

Inspect the parachute and check attachment to side of balloon, line anchorage and lower pulley(s) (if applicable) for operation.

Check all fabric strength with appropriate grab test.

Inspect the shroud lines for correct length and abrasion.

Inspect all connecting lines, such as centralizing, shroud, and valve lines for wear, correct length, burn damage, and knots.

Inspect all connecting pulleys, slide rings, and their side wall attachments (if applicable) for operation and integrity.

Rip Panel (if applicable)

Inspect the fabric and check for condition.

Inspect the appearance and performance of the velcro.

Inspect and check relative lengths of free load tapes and panel.

Inspect the rip-line, check line for wear and burn damage.

Inspect the line pulleys for proper operation and attachment.

Inspect and check the rip lock system (hooks, loops, "D" ring attachments).

Vent (if applicable) used in conjunction with rip top only envelope

Inspect the vent line, check for wear, damage and correct length.

Inspect the termination point for security and attachment.

Inspect the lower pulley for damage, operation and attachment.

Crown Line

Inspect for correct length, abrasion, knots, attachment method, and general condition.

Turning Vent

Inspect all vent lines, check for abrasion, melt damage and general condition.

Inspect the pulley(s) if applicable for operation and general condition.

Inspect the vent flap finger lines Kevlar/Polyester for damage and general condition.

Inspect the vent for freedom of operation.

Inspect the panel, tapes and elastic, check for damage and correct installation.

Tempil Labels (Tell Tales)

Inspect all installed tempil labels on the envelope or parachute.

Inspect latest installed label and register the envelope reading in the technical records.[1]

Inspect latest installed label and register the parachute reading in the technical records.[8]

Rigging Wires and Mouth Cables

Inspect the cable attachments including the cable covers for integrity.

Inspect the rigging wires, check for heat and abrasion, kinking, and broken strands.

Inspect the stainless steel cables (if applicable) for broken wire strands.

---

[1] Pursuant to CAR 605.92(3), all entries in respect of the technical records referred to in this list may be kept in the journey log.

Inspect the Kevlar cables (if applicable) for abrasion to core, or damage to splice stitching.

Inspect the cable swaging, heat shrink covers, and thimbles for condition and integrity.

Inspect all attaching parts for condition, security, and integrity.

Scoop or Skirt (if applicable)

Inspect the fabric, attachment points (knots and/or clips), and shock cords (if applicable), for condition and proper installation.

Temperature Sensing and Readout Equipment

Inspect the readout equipment for function and accuracy.

Inspect the cable and check for positive continuity and damage.

Inspect the thermistor and cable connectors (if applicable) for damage and security.

Burner and Fuel System

Inspect and confirm that all burners and fuel tanks are properly registered in the technical records.[2]

Inspect the burner unit(s) inner and outer frame for integrity.

Inspect the burner unit(s) for proper function of ignitor (if applicable), the pilot light(s), the main blast valve(s), the secondary burner valve, and the cross flow valve (if applicable).

Service the blast valve(s), and lubricate all fittings as required.

Inspect all fuel hoses for abrasions, cuts, cracking, and general condition.

Inspect all plumbing and cross flow systems (if applicable); lubricate as required.

Inspect the fuel cylinders for validity of the pressure test, check for damage, dents and corrosion.

Inspect the heat tape installation technique (if applicable) for integrity.

Perform a dip tube test on the fuel cylinders.

Perform a leak test of all plumbing and fittings, including any manifold systems installed.

Perform a fuel system pressure check, verify the operation of the cylinder and burner valves, fuel quantity gauges, and pressure readout gauges.

Inspect the carabiners and check for condition.

Inspect the burner unit, pilot light/ignitor.

[2] Pursuant to CAR 605.92(3), all entries in respect of the technical records referred to in this list may be kept in the journey log.

Basket

Inspect the identification plate, check for security, and confirm that the pertinent information in the technical records is accurate.[3]

Inspect the basket and all attaching parts, including the cables and their coverings for condition and integrity.

Inspect all upright systems, burner attachment systems, flexi poles (if applicable), covers, and padding for condition and security.

Inspect the instrument mounting system for condition, integrity and security.

Inspect the fire extinguisher for condition and security, and verify the validity of the pressure test.

Inspect the fuel tank securing system for condition and security.

Inspect the document display case for condition and security.

Inspect the drop line, check for kinks, abrasion, storage and security of attachment.

Inspect the drop line storage case for condition and security.

Instruments and Radios

Inspect the radios (where applicable) and all instruments for operation, security and accuracy.

Technical Records (and Documents)

Inspect the technical records[10] for compliance with the pertinent regulatory requirements.

Ascertain the availability of the required documents, and verify their regulatory compliance; such documents as:

the Flight Manual, the Annual Airworthiness Information Report, the Certificate of Airworthiness, the Certificate of Registration, the Radio License (if applicable), etc.

Review all Airworthiness Directives and Service Bulletins to determine their applicability and compliance, where required.

---

[3] Pursuant to CAR 605.92(3), all entries in respect of the technical records referred to in this list may be kept in the journey log.

Appendix C - Part 1
Curriculum and Topic Guides
Common Requirements - All Basic Training Courses
(amended 1999/12/01)

Regulatory Structure

Aeronautics Act

Canadian Aviation Regulations (CARs)

Standards

Advisory Material

CARs Numbering System

CARs
Part I - General Provisions

Subpart 1 - Interpretation

Subpart 2 - Application

Subpart 3 - Administration and Compliance

Subpart 4 - Charges

Part II
Aircraft Identification and Registration and Operation of a Leased Aircraft by a Non-Registered Owner

Subpart 1 - Identification of Aircraft and Other Aeronautical Products

Subpart 2 - Aircraft Marking and Registration

Part IV
Subpart 3 - Aircraft Maintenance Engineer Licenses and Training

403.01 Application

403.02 Requirement to Hold AME license

403.03 Issuance and Endorsement of AME License

403.04 Validity period of AME License

403.05 Recency Requirements

403.08 Approved Training Organizations

Part V

501 Annual Airworthiness Information Report

501.01 Requirement to Report

501.02 Information to be Reported

501.03 Reporting Schedule

507 Flight Authority

507.02 Certificate of Airworthiness

507.03 Special Certificate of Airworthiness

507.04 Flight Permit

507.05 Validation of Foreign Flight Authority

507.06 Application for Flight Authority

507.07 Flight Authority for an Imported Aircraft

507.08 Issuance of Additional Flight Authority

507.09 Operating Conditions

507.10 Persons Who May Attest to Condition and Conformity

507.11 Duration of a Flight Authority

507.12 Alteration of Document

509 Export Airworthiness Certificates

509.02 Application for an Export Airworthiness Certificate

509.03 Authority for Export

509.04 Persons Who May Attest to Condition and Conformity

509.05 Responsibilities of the Exporter

511 Approval of the Type Design of an Aeronautical Product

561 Manufacture of Aeronautical Products

563 Distribution of Aeronautical Products

566 Aircraft Maintenance Engineer Licensing and Training Standards

571 Aircraft Maintenance Requirements

571.01 Application

571.02 Maintenance Performance Rules

571.03 Recording of Maintenance and Elementary Work

571.04 Specialized Maintenance

571.05 Maintenance of Aeroplanes or Helicopters Operated Pursuant to Part IV and aircraft operated pursuant to Part VII

571.06 Repairs and Modifications

571.07 Installation of New Parts

571.08 Installation of Used Parts

571.09 Installation of Life-Limited Parts

571.10 Maintenance Release

571.11 Persons who May Sign a Maintenance Release

571.12 Reporting Major Repairs and Major Modifications

571.13 Installation of Parts (General)

Schedule I - Personnel Certification for Non-Destructive Testing (NDT)

Schedule II - Specialized Maintenance

573 Approved Maintenance Organization

573.01 Application for Approval

573.02 Entitlement to and Scope of Certificate

573.03 Person Responsible for Maintenance

573.04 Assignment of Management Functions

573.05 Authorization to Sign a Maintenance Release

573.06 Training Program

573.07 Personnel Records

573.08 Facilities, Equipment, Standards and Procedures

573.09 Quality Assurance Program

573.10 Maintenance Policy Manual

573.11 Maintenance Arrangements

573.12 Service Difficulty Reporting

573.13 Foreign Approvals

573.14 Identification of an AMO

591 Service Difficulty Reporting

591.01 Reporting Requirements

593 Airworthiness Directives

593.01 Applications

593.02 Conditions for Issuance

Part VI
Subpart 4 - Private Operator Passenger Transportation
Division VI Maintenance

604.48 Maintenance Control System

604.49 Description of Maintenance Control System in Operations Manual

604.50 Person Responsible for Maintenance Control System

604.51 Maintenance Personnel and Facilities

604.52 Defect Reporting and Recertification Control Procedures

604.53 Service Difficulty Reporting

604.54 Technical Dispatch Instructions

604.55 Service Information Review

604.56 Maintenance Agreements

604.57 Maintenance Training

Part VI
Subpart 5
Division I - Aircraft Requirements - General

605.03 Flight Authority

605.04 Availability of Aircraft Flight Manual

605.05 Markings and Placards

605.06 Aircraft Equipment Standards and Serviceability

605.07 Minimum Equipment Lists

605.08 Unserviceable and Removed Equipment - General

605.09 Unserviceable and Removed Equipment - Aircraft with a Minimum Equipment List

605.10 Unserviceable and Removed Equipment - Aircraft Without a Minimum Equipment List

Division III - Aircraft Maintenance Requirements

605.84 Aircraft Maintenance - General

605.85 Maintenance Release and Elementary Work

605.86 Maintenance Schedule

605.87 Transfer of Aeronautical Products Between Maintenance Schedules

605.88 Inspection after Abnormal Occurrences

Division IV - Technical Records

605.92 Requirement to Keep Technical Records

605.93 Technical Records - General

605.94 Journey Log Requirements

605.95 Journey Log - Carrying on Board

605.96 Requirements for Technical Records Other Than the Journey Log

605.97 Transfer of Records

Part VII
Subpart 6 - Aircraft Maintenance Requirements for Air Operators

706.01 Application

706.02 Maintenance Control System

706.03 Person Responsible for the Maintenance Control System

706.04 Maintenance Personnel and Facilities

706.05 Defect Rectification and Control Procedures

706.06 Technical Dispatch Procedures

706.07 Evaluation Program

706.08 Maintenance Control Manual (MCM)

706.09 Maintenance Arrangements

706.10 Elementary Work

706.11 Servicing

706.12 Training Program

706.13 Personnel Records

706.14 Service Difficulty Reporting

Appendix C - Part 2
Curriculum and Topic Guides
Small and Large Aircraft Maintenance
Training Standard
(amended 1999/12/01)

1.0 GENERAL

Identify:

1. The different classes of fires and suitable extinguishers.

Explain:

2. The legal and moral responsibilities of maintenance technicians and AMEs.

3. Human factors in maintenance.

Perform:

4. Tasks utilizing health and safety practices, including handling of chemicals, metals, pyrotechnics and hazardous materials, environmental considerations, workplace hazardous materials information system or equivalent.

5. Tasks extracting information from technical drawings including ATA system.

2.0 HAND TOOLS/PRECISION INSTRUMENTS

Perform:

1. Tasks utilizing the proper selection and use of hand and power tools.

3.0 METALLURGY

Identify:

1. The types of corrosion.

Explain:

2. The hardness testing process.

3. Relevant manufacturing treatment processes of aircraft metals.

4. The fundamentals of NDT processes including, visual inspection, liquid penetrant inspection, ultrasonic inspection, eddy current inspection, magnetic particle inspection, radiography etc.

5. The methods of corrosion treatment and prevention.

6. The inspection processes for welds.

7. The inspection process for bonds.

Perform:

8. Tasks identifying the types, properties and coding of aircraft metals.

9. Visual inspection and liquid penetrant inspection.

4.0 AIRCRAFT SERVICING

Explain:

1. Servicing of aircraft systems such as water, waste, oxygen, etc.

2. The classifications, functions principles and properties of lubricants including: engine oil, grease and hydraulic fluids.

3. Aircraft deicing procedures.

4. Operating procedures and safety precautions of ground support equipment required to service the aircraft.

5. Aircraft grooming procedures and precautions.

6. Aircraft storage procedures.

Perform:

7. A fuel contamination check.

8. Tire servicing and inflation.

9. Servicing of aircraft main batteries.

10. Servicing of lubrication, fuel, oil and hydraulic systems.

11. Standard ground handling practices.

12. Jacking of an aircraft.

5.0 APPROVED PARTS

Identify:

1. Aircraft hardware using AN, MS, NAS parts systems.

Explain:

2. The application of metric and British Unified Systems to aircraft hardware.

3. The needs and rationale for aircraft specifications such as MIL, NAS.

4. The inventory control system including traceability, requisitioning, quarantine and bonded stores.

Perform:

5. Installation and securing of standard hardware and connectors.

6.0 AERODYNAMICS

6.1 Fixed Wing Aircraft

Explain:

1. The theory of flight, relative motion, dynamic stability, standard atmosphere, fluid dynamics, lift, drag, thrust and weight, forces and balance, stalling/landing speeds, speed of sound, aerodynamic loads, and high speed flight

2. The purpose of flight controls including primary, secondary, and auxiliary controls, lift and anti-lift devices.

6.2 Rotary Wing Aircraft

Explain:

1. Theory of flight applicable to rotary wing including:

- coriolis effect
- retreating blade stall
- auto-rotational characteristics
- transverse flow
- dissymmetry of lift
- ground effect

6.3 Fixed Wing Controls and Rigging

Identify:

1. Types of flight controls and explain features and functions of flight control systems.

Explain:

2. Mechanical flight control system and components.

3. Servo powered flight control system and components.

4. Cables, fittings and repair of associated rigging hardware.

5. Incidence, symmetry checks and adjustments.

6. The purpose and principles of flight control artificial feel/feedback systems.

7. The systems which modify flight control travel due to altitude, velocity or other factors e.g. rudder travel limitation, aileron lockout, lift dump.

Perform:

8. Inspection of cable and control rod type flight control system.

9. Rigging of cable operated primary flight control system.

10. A cable repair.

6.4 Rotary Wing Controls and Rigging

Explain:

1. Elements of the drive train including:
   - transmission
   - clutches and freewheeling
   - drive shaft systems
   - gearboxes (intermediate and tail rotor)
   - ducted fan systems including NOTAR and Fenestron
   - gear construction, installation, types, ratios, patterns, lubrication and backlash
   - bearings and seals (friction, anti-friction, elastomeric)
   - rotor head types and design including:
   - rigid
   - semi-rigid
   - fully articulated
   - rotor blade design, construction and types

2. The various fundamentals of flight control systems including:
   - rotating controls
   - non rotating controls
   - forced trim
   - forced gradient
   - swash plate
   - spider system
   - servo tabs

3. The various fundamentals of flight control rigging including:
   - cyclic rigging
   - collective rigging
   - anti-torque devices
   - elevators
   - correlation devices
   - droop compensators

4. The fundamentals and effects of vibration.

5. Vibration types and causes including:
   - vertical
   - lateral
   - high frequency
   - harmonics

- low frequency
- medium frequency
- nodes

6. Vibration canceling devices including:
   - dampers
   - bifilar

7. Landing gear types and systems including:
   - skids
   - floats
   - wheels
   - pop out floats
   - retractable gear

8. Rotor tracking and balancing requirements, analysis and rectification.

9. Autorotational RPM adjustments.

10. Inspection requirements including:
    - sudden stoppage
    - hard landing
    - overspeed
    - over torque
    - periodic inspections

11. Operational safety practices including approaching and exiting a running helicopter.

12. Ground crew responsibilities and precautions applicable to slinging external loads.

Perform:

13. Alignment and static balance procedures for a semi-rigid rotor head.

14. Tracking and dynamic balance of a main and tail rotor system using a simulator

15. The testing, troubleshooting, repair, adjustment, removal and replacement of dynamic components

7.0 SHEET METAL

Explain:

1. The difference between a structural and non-structural repair.

2. The application and installation/removal of special fasteners.

3. The requirements for scratch inspection.

4. The purpose and use of sealant.

Perform:

5. Installation, inspection and removal of solid rivets.

6. Installation, and removal of standard fasteners.

7. Sheet metal repairs including cutting, bending, forming and fabricating.

8.0 AIRCRAFT STRUCTURES

Identify:

1. Structural members and stress involved in floats, hulls, skis, stabilizers, wings, engine mounts, cowlings and fuselages.

Explain:

2. Types of primary aircraft structures.

3. The fabric surfaces and wood components including inspection, materials, process, fabric repairs, wood types, uses, and repair.

9.0 PLASTICS AND COMPOSITES

Explain:

1. Reinforcement fibers, matrix materials, core materials, manufacturing techniques composite safety, methods of curing, pre-pregs, temperature and pressure applications.

2. Inspection, damage assessment and repair procedures.

Perform:

3. A repair using the following procedures:

- wet lay-up
- core repair.

10.0 WINDOWS AND LENSES

Explain:

1. The construction of windows and lenses.

2. Inspection, repair, servicing and installation of windows and lenses.

3. Damage assessment of windows and lenses.

4. Handling and storage of windows and lenses.

11.0 PISTON ENGINES

11.1 Basics

Explain:

1. The calculation of energy, work and horsepower.

2. The two stroke cycle and the Otto cycle.

3. Piston engine classification terminology (e.g. TSIO-520, R985).

11.2 Cooling and Lubrication of Engines

Explain:

1. The purpose and methods of engine cooling.

2. The functions, principles and properties of lubricating oil.

3. Lubrication systems including oil dilution and cold weather operations.

Perform:

4. The selection of the appropriate lubricants.

11.3 Component Parts of a Reciprocating Engine Assembly

Explain:

1. The purpose of parts including the following:

- crankshaft
- connecting rods
- bearings
- pistons
- cylinders
- accessory/propeller gearing
- valves and valve train
- crankcase

2. The procedure for lapping valves and seats, replacing bushings, removing nicks, burrs, scratches, scores, and replacing damaged studs.

Perform:

3. Disassembly, cleaning, inspection, measuring and reassembly of the engine.

11.4 Carburetion Principles

Describe:

1. Characteristics of fuel and fuel/air metering systems

2. Carburetion principles and components as they apply to float type and pressure injection carburetors, single and multi-point fuel injection systems.

3. Induction system principles and components as they apply to normally aspirated, supercharged and turbocharged engines.

4. The operation of turbocharger control systems.

11.5 Ignition Systems

Explain:

1. The principles of operation and identify the components of reciprocating engine ignition systems.

Perform:

2. The timing and installation of a magneto and ignition harness.

3. The inspection, servicing and testing of magneto ignition system components.

11.6 Installing, Testing, Troubleshooting Engines

Explain:

1. Run-in procedures including testing and troubleshooting.

2. The purpose and procedure for engine inhibiting.

Perform:

3. Engine removal and installation including installation of accessories and component systems.

4. Reciprocating engine run-up.

12.0 TURBINE ENGINES

12.1 Basics

Explain:

1. Development, fundamentals and principles of operation of turbine engines.

2. Engine design and construction pertaining to:

- inlet ducts
- compressors
- bleed valves
- diffusers
- vane controllers
- combustion section
- turbines
- exhaust section
- gear boxes
- bearings and seals
- engine mounts

3. Factors affecting thrust/torque.

4. The mathematics and physics relating to thrust production including the Brayton cycle and thrust calculations.

5. The purpose and advantages of modular construction.

6. Common designs of turbine engines including:

- torque producing engines
- thrust producing engines
- turboshaft and turboprop
- turbojet and turbofan

7. The principles of noise suppression techniques.

8. Turbine engine systems including fuel, lubrication, ignition, air, exhaust.

Define:

9. Common turbine engine terminology and acronyms

12.2 Fuel and Control

Explain:

1. Explain fuel systems including:

- electronic fuel control
- hydro-mechanical fuel control
- pneumatic fuel control overspeed
- governors
- fuel manifolds and nozzles
- fuel heater
- fuel filter
- fuel system indication (flow pressure and temperature)

Perform:

2. Fuel nozzle inspection, servicing, testing and safety precautions.

12.3 Ignition

Explain:

1. Types and operation of turbine engine ignition systems and their components including:

- low tension (glow plugs)
- high tension (capacitive discharge)
- auto re-light

2. Turbine engine ignition system safety precautions.

Perform:

3. Ignition systems servicing and inspection procedures.

12.4 Starting

Explain:

1. Design and components of starting systems.

2. The operation of various turbine engine starters including air turbine starters, electrical starters, (motor and starter-generator).

3. Inspection and servicing procedures for starting systems.

4. The operation of an auto-start system.

Perform:

5. The inspection and servicing of an electrical turbine engine starter.

12.5 Engine Controls

Explain:

1. Rigging requirements for gas turbine controls and systems.

2. Adjustments of fuel controls including:

- acceleration/deceleration check
- minimum flow
- maximum speed
- idle speed
- part power trim check
- shut off

3. Mechanical, electronic interface, Full Authority Digital Engine Control (FADEC) systems.

12.6 Lubrication

Explain:

1. Types and requirements of turbine oil.

2. Engine lubrication system principles and component operation including:

- wet sump
- dry sump
- scavenge pumps
- pressure pumps
- bearings and seals
- oil pressure regulator
- air oil separators
- oil coolers

- oil filters
- oil jets

3. Contamination monitoring system operation principles including:
   - chip detectors
   - filters
   - spectrometric oil analysis program (SOAP)

12.7 Exhaust

Explain:

1. Types, operation and control of thrust reverse systems including hot and cold stream.
2. Principles of thrust vectoring systems.
3. Principles and engine trimming associated with exhaust ducts.

12.8 Air

Explain:

1. General air systems of turbine engines including the following:
   - anti-ice air
   - de-ice air
   - bleed valves
   - customer bleed air
   - case cooling/heating (clearance control)
   - control air
   - temperature and pressure regulation
   - filters

12.9 Engine Indicating Systems

Explain:

1. Principles and operation of engine indicating systems including:
   - speed indication
   - temperature indication
   - pressure indication
   - flow metering systems
   - quantity indication (oil quantity)
   - fault detection (chip detector, filter bypass)
   - power indication systems engine pressure ratio (EPR)
   - torque indication
   - status enunciators
   - built in test equipment (BITE) system
   - vibration indication

12.10 Gear Box

Explain:

1. Purpose, function and types of engine gear boxes including:
   - accessories and accessory drives
   - gear reduction systems
   - attachment devices
   - fault detection analysis -chip detectors and filter attachment
   - torque measurement system
   - gear types

12.11 Engine Water Injection

Explain:

1. The purpose and operation of water methanol injection systems.

12.12 Inspection/Servicing

Explain:

1. Handling and safety precautions.
2. The purpose and procedures for trend monitoring and power checks.
3. Fundamentals of vibration analysis.
4. Turbine engine inspection procedures including:
   - hot end inspection
   - borescope inspection.
5. The engine start and shut down procedure.
6. Requirements and procedures for compressor wash.
7. Safety precautions and hazards while ground running including:
   - foreign object ingestion
   - jet/prop blast
   - turbine burst
   - personnel
   - hazards created by deviation from procedures (integrated systems)
   - aircraft restraint (chocks, tie downs etc.).
   - noise
8. Engine installation and test procedures.

Perform:

9. Procedures for calculating engine cycle counts.

10. A hot section inspection.

11. A simulation of a power check including calculating engine performance from manufacturer's performance charts and interpret data to determine faults such as:

- faulty indication
- compressor defect
- turbine defect
- fuel nozzle contamination
- air leaks
- excessive bleed air
- rigging faults

12. Engine ground run (students must be involved in live engine operation).

13.0 Propellers and Systems

Explain:

1. Theory and design of aircraft propellers including:
   - forces acting on a propeller
   - lift and angle of attack
   - propeller construction materials
2. Fixed pitch, controllable pitch, constant speed, feathering and reversing propellers.
3. Methods of controlling propeller pitch including:
   - springs
   - counter weights
   - hydraulic
   - pneumatic
   - electric
   - ground adjustable
   - propeller control systems including:
   - governors
   - synchronizers
   - synchrophasers
   - feathering and unfeathering
   - reversing
   - unfeathering accumulators
   - negative torque sensing
   - auto feather
4. Propeller indication including:
   - speed sensing

- torque sensing
- blade angle indication

5. Propeller installation and maintenance including:
    - flange mount
    - spline shaft
    - taper shaft
    - blade repair
    - inspection techniques
    - balancing
    - tracking

6. Propeller disassembly and reassembly including:
    - blade installation
    - hub setup
    - electrical connection
    - associated systems (de-ice, beta pickups)
    - spinner backing plates

Perform:

7. Propeller installation, safe operation, inspection, adjustment and minor repair.

14.0 HYDRAULIC and PNEUMATIC POWER

Explain:

1. Safety precautions, including high pressure bottles and accumulators.
2. Fluid dynamics, types of fluid and system components.
3. System design including multiple and integrated systems and system redundancy.
4. System maintenance.

Perform:

5. Operation, inspection and testing of a hydraulic system.
6. Servicing of a high pressure accumulator.

15.0 PNEUMATICS

Explain:

1. The differences between hydraulic and pneumatic systems.
2. The principles of operation, components, maintenance and servicing of a pneumatic system including:
    - temperature regulation
    - flow control

- pressure control
- sources and common applications

16.0 AIRCRAFT PLUMBING

Explain:

1. The standard fittings and hardware identification systems.

Perform:

2. Assembly, installation, inspection and testing of hose and rigid tube assemblies.

17.0 LANDING GEAR

Explain:

1. The various types and configurations of landing gear assemblies including shock absorbing and non-shock absorbing systems.

2. The purpose and operation of shimmy dampers.

3. The operation of components of landing gear retraction and anti-retraction systems.

4. The operation and components of hydraulic and mechanical, emergency extension systems.

5. Various brake types.

6. Anti-skid and skid warning systems.

7. Basic, boosted, power, automatic and emergency braking systems and components.

8. Brake indicating systems including break wear and temperature indication.

9. Mechanical and powered steering systems.

10. The purpose of air ground sensing systems.

Perform:

11. Disassembly, reassembly and servicing of an oleo.

12. Removal, disassembly, visual inspection, reassembly, servicing and installation, of wheels, tubes and tires.

13. A retractable landing gear inspection including a gear swing and functional check.

14. Basic brake system inspection and servicing.

15. Installation and rigging check of floats or skis.

18.0 ENVIRONMENTAL CONTROL SYSTEMS

Identify:

1. Air sources for cabin pressurization.

Explain:

2. Fundamentals of heating, cooling and ventilation systems and their components including:

- air cycle machine
- vapour cycle cooling
- bleed air heating
- heat exchangers
- exhaust type heaters
- combustion type heaters

3. Electrical/electronic equipment cooling systems.

4. Cabin pressure fundamentals and components including system safety precautions and functional tests.

5. The various oxygen system fundamentals and component operation including:

- solid state/chemical oxygen
- liquid oxygen
- gaseous oxygen

Perform:

6. The inspection and servicing of environmental control systems including:

- heating systems including exhaust type heaters and combustion heaters
- oxygen storage systems utilizing standard handling and safety procedures

19.0 FUEL

Explain:

1. Fuels - types, properties and additives.

2. Airframe fuel system configurations and component functions including:

- storage
- jettison
- distribution
- venting
- grounding
- indication

Perform:

3. Fuel system maintenance and safety precautions

20.0 ICE AND RAIN PROTECTION

Explain:

1. Causes and types of ice formation.

2. Types of ice detection systems.

3. Anti-ice and de-ice systems and principles of operation including:

- propeller/rotor
- powerplant (air inlets, external sensors, fuel heaters)
- windshields
- air data gathering devices
- vents and drains
- airframe surfaces
- water/waste systems

4. Rain repellent systems.

Perform:

5. Operation, inspection and testing of an ice protection system.

21.0 EMERGENCY SYSTEMS

Identify:

1. The types and operation of emergency lighting systems.

2. The types of ELTs including Underwater Locating Devices (ULDs).

Explain:

3. Requirements and procedures for inspecting, installing and testing of ELTs.

4. Flotation device types, inspection and servicing including personal flotation devices, and airframe flotation devices.

5. Emergency breathing apparatus.

21.1 Fire Protection

Describe:

1. Various types of aircraft fire detection systems e.g. spot detectors, continuous loop, infra-red and ultra-violet.

2. Various types of suppression and extinguishing systems and safety precautions including aircraft installed and portable.

Perform:

3. Fire detection system inspection and operational test.

22.0 ELECTRICITY AND ELECTRICAL/ELECTRONIC SYSTEMS

22.1 Basic Electricity DC

Explain:

1. Electron theory and electrostatics.
2. Magnetism and electromagnetism.
3. Electromagnetic induction.
4. Units of electrical measurement:
    - voltage
    - current
    - resistance
5. Sources of electrical energy.
6. Characteristics of series, parallel, and series/parallel circuits.
7. Laws and theorems utilized in DC circuit analysis.
8. Circuit control devices including, but not limited to:
    - switches
    - relays
    - fuses
    - circuit breakers
    - capacitors
    - capacitance in DC circuits
    - construction and operation of diodes
    - construction and operation of transistors
9. DC motors and generator principles
10. Electron theory and electrostatics.

Perform:

11. Circuit calculation using laws and theorems associated with DC circuit analysis.
12. Tasks utilizing a multimeter to measure voltage, resistance and current in a DC circuit.
13. Calculations to substantiate the theories of Ohm's Law and Kirchhoff's Law.
14. Measurement of different battery types under load and no-load conditions.

15 Construction of an electromagnet.

16. Construction of electrical circuits from components that are the same as those previously solved mathematically.

Test, Troubleshoot, Repair, Adjust, Remove and Replace:

17. DC generator, an aircraft DC motor, an aircraft alternator.
18. Test diodes and transistors for serviceability.
19. Switches, relays, circuit breakers, and fuses.

22.2 Basic Electricity - AC

Identify:

1. A wiring diagram for a simple alternator circuit, then accomplish the wiring of the same circuit.

Describe:

2. AC current.

3. Inductive pickups.

4. The effects of capacitors in electrical circuits.

5. The use for capacitors.

6. Differences between AC and DC motors.

7. The use of AC alternators in aircraft.

8. Generator Control Units.

9. Single-phase AC actuator motors.

10. Three-phase AC motors.

11. The use of the common measuring devices.

Explain:

12. Principles of AC theory

13. Rms and peak values

14. Frequency, period, phase

15. Use of AC measuring devices, including, but not limited to, multimeters and oscilloscopes

16. Polyphase AC circuits

17. Aircraft application of AC

18. Inductance coils, inductors and inductance in AC circuits

19. Transformers

20. Capacitors and capacitance in AC circuits

21. Reactance and impedance

22. Resonant circuits

23. Phase angle, and power factor calculations

24. Frequency and phase.

25. AC generation theory, including construction and maintenance of alternators.

26. The use of the multimeters, oscilloscope and other AC measuring devices.

27. Impedance.

28. Transformers.

29. The principles of AC generation.

30. Aircraft alternators.

31. Voltage regulation.

32. Inverters.

33. Variable-speed, constant-frequency power systems.

34. AC motors.

35. Improvement of starting qualities.

36. Repulsion motors.

37. Synchronous motors.

38. Motor losses.

39. Power conversion methods.

40. Using diodes to convert AC to DC.

Perform:

41. Circuit calculations using laws and theorems associated with AC circuit analysis.

42. Tasks demonstrating the proper use of test equipment to measure voltage, current, reactance and frequency in AC circuits.

43. Serviceability test of a diode and a transistor.

44. Evaluation of lab equipment.

45. AC voltage and capacitance measurement.

46. A transformer characteristics experiment using a semi-conductor.

47. Applications using an oscilloscope and other common measuring devices.

48. Inspection and servicing of motors.

22.3 Electrical Systems

Identify:

1. Electrical diagram symbols for control and protection devices.

2. Components which make up aircraft electrical motor circuits.

Describe:

3. Various types of wiring diagrams, drawings and schematic symbology.

4. Basic circuit components.

5. Maintenance of electrical wiring systems.

6. Types of electrical control devices.

7. Types of electrical circuit protection devices.

8. Electrical supply and generation components.

9. Maintenance of electrical power supply and generation systems.

10. Aircraft indication, monitoring and lighting circuits.

11. Various troubleshooting techniques.

12. Electrical motor theory.

13. Electrical components of a landing gear system.

14. Servicing and inspection of electrical landing gear system.

15. Safety procedures for maintenance of electrical systems.

Explain:

16. Construction, maintenance, and operation of aircraft batteries (all types).

17. Construction, maintenance, and operation of aircraft generators (DC).

18. Construction, maintenance, and operation of aircraft generators (AC).

19. Construction, maintenance, and operation of aircraft alternators.

20. Construction, maintenance, and operation of TRUS.

21. Construction, maintenance, and operation of generator control units (GCUS).

22. Construction, maintenance, and operation of constant speed drives and integrated drive generators (IDG).

23. Current transformers.

24. Construction, maintenance, and operation of aircraft inverters (rotary and static).

25. Construction, maintenance, and operation of aircraft motors (AC and DC).

26. Construction, maintenance, and operation of aircraft synchros, including transmitters (receivers and resolvers).

27. Proper use of test equipment and support curriculum.

28. Wiring practices, including wire and coaxial cable specs (MIL and FAA).

29. Bonding EMI/RFI suppression techniques.

30. Light aircraft electrical power distribution systems (single and multi engine).

31. Large multi engine aircraft electrical power distribution systems.

Perform:

32. Tasks using wiring diagram(s), and appropriate test equipment to troubleshoot an electrical power distribution system fault.

33. The following tasks, employing acceptable methods, techniques and practices:
    - wire stripping
    - soldering and desoldering
    - various crimping methods
    - various splicing techniques
    - looming procedures
    - harness and connector assembly
    - wire routing, looming, clamping and lacing
    - wire selection and identification
    - electrical load analysis

34. Reading of electrical supply power generation systems wiring diagrams.

35. Servicing and charging of a lead acid battery in a battery shop.

36. Servicing and deep cycling of a nickel-cadmium battery in a battery shop.

37. The installation and removal of a nickel-cadmium battery of an aircraft.

38. Installation and removal of a lead acid battery on an aircraft.

39. Construction of a basic wiring harness using acceptable methods, techniques and practices.

40. Troubleshooting of various control and protection devices as required by schematic diagram of a simple aircraft circuit.

41. Servicing and testing of an alternator and generator.

42. Connection and testing of components to simulate an aircraft generation system.

43. Troubleshooting of a given defect in an aircraft electrical system, employing the circuit diagram and appropriate test equipment.

44. Inspection and testing of an aircraft motor system components.

45. Testing, troubleshooting, repair, adjustment, removal and replacement of a motor, generator or alternator.

22.4 Aircraft Instrumentation

Identify:

1. Both mechanically operated and electrical/electronic operated.
2. Instruments according to function.

Describe:

3. The vertical, and instantaneous-vertical speed indicators.
4. A vacuum pump system.
5. Various display types.
6. Various methods of display.
7. Electrical flight instruments.
8. Engine electrical indicating instruments.
9. Engine instrument installation and marking.
10. Testing of engine electrical indicating instruments.
11. Systems that employ electrical indicating instruments.
12. Maintenance of systems electrical indicating instruments.
13. The types of instruments using direct drive linkages.
14. Installation of direct linkage and drive mechanisms.
15. Servicing of pitot/static instruments.

Explain:

16. The reasons for using instrumentation.
17. The principles of absolute pressure measurement.
18. The principles of gauge pressure measurement.
19. The principles of differential pressure measurement.
20. Altimeters.
21. Airspeed indicators.
22. Air data computers (ADC).
23. Electrically driven instruments.
24. Temperature measuring instruments.

25. Gyroscopic principles.
26. The sources of power of gyroscopes.
27. Gyro attitude instruments.
28. Rate gyro instruments.
29. The principles of navigation.
30. The procedures for correcting errors (compass swing).
31. The procedure for setting up test equipment.

Perform:

32. A functional check of a pitot/static system.
33. Draining of a pitot/static system.
34. Inspections of instruments for correct installation and markings.
35. A functional check on a liquid pressure instrument system.
36. A check of aircraft instruments for correct function.
37. A functional test of an exhaust gas temperature system employing suitable testing.
38. Packaging of an instrument for shipping.
39. A functional check of a fuel quantity indication system.
40. A simulated compass swing.

22.5 Avionics

Identify:

1. Aircraft radio antennas.

Describe:

2. Audio components.
3. Transmission lines.

Explain:

4. Radio theory.
5. Radio transmitters.
6. Radio receivers.
7. Superheterodyne operation.
8. Modulation (AM/FM).

9. Digital communications.
10. HF communication systems.
11. VHF communication systems.
12. SELCAL.
13. Interphone systems (flight / service).
14. Audio integration.
15. Passenger entertainment systems (multiplex/audio/video).
16. ELTs.
17. Satellite communication systems.
18. Navigation principles.
19. Flight Management Systems.
20. Inertial Navigation Systems.
21. Inertial Reference Systems.
22. Radio Navigation Systems, including, but not limited to:
    - DF
    - VOR
    - ILS
    - GPS
    - DME
    - ATC transponder
    - WX radar
    - radio altimeters
    - TCAS
    - GPWS
23. Video displays, EFIS, EICAS, Flight Data Recorders, Cockpit Voice Recorders.
24. Frequency spectrum.
25. IFR versus VFR.
26. Maximum power transfer theorem.
27. Functions of audio control panels.
28. Functions of communication controls.
29. Antenna fundamentals.
30. HUMS (health and usage monitoring system).
31. Avionics installation practices.

32. Avionics maintenance inspections and system troubleshooting.

33. Interconnections of avionics systems.

Perform:

34. Operational check and inspection of a COM T/R system and one NAV system to the LRU (Line Replaceable Unit) level on an avionics installation.

35 Inspection of an antenna system.

36. Removal and replacement of an avionics LRU or component.

37. Tasks utilizing a multimeter or equivalent to troubleshoot an avionics wiring interconnection fault.

22.6 Data Bus and Logic

Describe:

1. Number systems.
2. Use of electrical circuit representations to explain logic gates.
3. Boolean equations.
4. The display of digital data.
5. Characteristics of integrated circuits.
6. Some applications of integrated circuits.
7. Use of electrical circuit representations to explain logic gates.
8. Functions of computer operations.
9. Aircraft digital systems.
10. Air Data Computer Systems.
11. Flight Management Systems.
12. Thrust Management Systems.
13. Systems testing and troubleshooting.
14. Safety procedures.

Explain:

15. The difference between analog and digital systems.
16. Logic gates using truth tables.

Perform:

17. Determination of correct digital output, given a logic diagram with digital inputs.

18. Conversion between various numbering systems.

22.7 Auto Flight Systems

Explain:

1. Introduction to and system overview of:

- single and multiaxis autopilot
- yaw damper systems
- flight director systems
- speed command

- stability augmentation systems
- auto throttle
- thrust management
- VNAV

Perform:

2. Inspection and operation check of an auto-pilot system.

23.0 MAINTENANCE PROCEDURES

Explain:

1. Inspection and maintenance requirements for private and commercial aircraft as outlined in the *Canadian Aviation Regulations*.

2. Fundamentals and types of aircraft inspections including:

- periodic, annual, progressive and approved maintenance schedules
- abnormal occurrence (hard landing, lightning strike, etc.).
- special (Airworthiness Directive or Service Bulletin).

3. Weight and balance procedures and requirements including:

- jacking
- leveling
- weighing
- installed equipment list
- weight and balance report
- amendment requirements
- regulatory requirements

4. Differences between fixed and rotary wing aircraft weight and balance procedures, e.g. Lateral center of gravity.

5. Fundamentals of quality assurance.

Perform:

6. A weight and balance procedure on an aircraft, including associated documentation.
7. Completion of documentation for maintenance records including:
   - technical records
   - technical reports
   - defect lists
   - service difficulty reporting
8. Computerized information input and retrieval.
9. A typical rotorcraft and fixed wing maintenance schedule (e.g. 100 hour or annual inspection)
10. Tasks utilizing Minimum Equipment Lists, Configuration Deviation Lists and Built-In Test Equipment (Bite) programs

24.0 IMPERIAL AND RELATED UNITS OF MEASURE

Perform:

1. Calculations including conversions using:
   - Length: feet, inches, statute mile, nautical mile
   - Velocity: feet/sec., miles/hr, knots
   - Weight/mass: pounds, ounces
   - Volume: pints, quarts, imperial gallons, U.S. gallons
   - Temperature: Fahrenheit, Celsius, Rankine, Calvin

Appendix C - Part 3
Curriculum and Topic Guides
Electronics Systems Maintenance Training Standard
(amended 1999/12/01)

1.0 GENERAL

Identify:

1. The different classes of fires and suitable extinguishers.

Explain:

2. The legal and moral responsibilities of maintenance technicians and ames.
3. Human factors in maintenance.

Perform:

4. Tasks utilizing health and safety practices, including:
   - handling of:
     - chemicals
     - metals
     - pyrotechnics
     - hazardous materials
   - environmental considerations
   - WHMIS or equivalent
5. Tasks extracting information from technical publications including ATA system.

2.0 HAND TOOLS/PRECISION INSTRUMENTS

Perform:

1. Tasks utilizing the proper selection and use of hand and power tools.

3.0 METALLURGY

Identify:

1. The type of corrosion.

Explain:

2. The methods of corrosion treatment and prevention.

Perform:

3. Tasks identifying the types, properties and coding of aircraft metals.

4. Relevant manufacturing treatment processes of aircraft metals.

4.0 AIRCRAFT SERVICING

Explain:

1. Servicing of aircraft systems such as water, waste, oxygen, etc.

2. The classifications, functions principles and properties of lubricants including, engine oil, grease and hydraulic fluids.

3. Aircraft deicing procedures.

4. Operating procedures and safety precautions of ground support equipment required to service the aircraft.

5. Aircraft grooming procedures and precautions.

Perform:

6. A fuel contamination check.

7. Tire servicing and inflation.

8. Servicing of aircraft main batteries.

9. Servicing of lubrication, fuel, oil and hydraulic systems.

10. Standard ground handling practices.

11. Jacking of an aircraft.

5.0 APPROVED PARTS

Identify:

1. Aircraft hardware using AN, MS, NAS parts systems.

Explain:

2. The application of metric and British unified systems to aircraft hardware.

3. The needs and rationale for aircraft specifications such as MIL, NAS.

4. Inventory control including:

- traceability
- quarantine
- requisitioning
- bonded stores

Perform:

5. Installation and securing of standard hardware and connectors.

6.0 AERODYNAMICS

6.1 Fixed Wing Aircraft Aerodynamics

Explain:

1. The theory of flight, relative motion, dynamic stability, standard atmosphere, fluid dynamics, lift, drag, thrust and weight, forces and balance, stalling/landing speeds, speed of sound, aerodynamic loads, and high speed flight.

2. The purpose of flight controls including primary, secondary, and auxiliary controls, lift and anti-lift devices.

6.2 Rotary Wing Aircraft Aerodynamics

Explain:

1. Theory of flight applicable to rotary wing including:

- coriolis effect
- retreating blade stall
- auto-rotation characteristics
- dissymmetry of lift
- ground effect
- transverse flow

6.3 Flight Controls and Rigging

Identify:

1. Types of flight controls and explain features and functions of flight control systems.

Explain:

2. Mechanical flight control system and components.

3. Servo powered flight control system and components.

4. Cables, fittings and repair of associated rigging hardware.

5. Incidence, symmetry checks and adjustments.

6. The systems which modify flight control travel due to altitude, velocity or other factors.

7. Rudder travel limitation, aileron lockout, lift dump.

8. The purpose and principles of flight control artificial feel/feedback systems.

7.0 SHEET METAL

Explain:

1. The difference between a structural and non-structural repair.
2. The application and installation/removal of special fasteners.
3. The requirements for scratch inspection.
4. The purpose and use of sealant.

Perform:

5. Installation, inspection and removal of solid rivets.
6. Installation, and removal of standard fasteners.
7. Sheet metal repair/modification including cutting, bending, forming and fabricating.

8.0 AIRCRAFT STRUCTURES

Identify:

1. Structural members and stress involved in:
   - floats
   - hulls
   - skis
   - stabilizers
   - wings
   - engine mounts
   - cowlings
   - fuselages
2. Types of primary aircraft structures.

10.0 PISTON ENGINES

10.1 Basics

Explain:

1. Basic design and theory of operation.
2. The calculation of energy, work and horsepower.
3. The two stroke cycle and the otto cycle.
4. Piston engine classification terminology (e.g. Tsio-520).

10.2 Ignition systems

Explain:

1. The principles of operation and identify the components of reciprocating engine ignition systems.

11.0 TURBINE ENGINES

11.1 Basics

Explain:

1. Development, fundamentals and principles of operation of turbine engines.
2. Engine design and construction pertaining to:
   - inlet ducts
   - compressors
   - bleed valves
   - diffusers
   - vane controllers
   - combustion section
   - turbines
   - exhaust section
   - gear boxes
   - bearings and seals
   - engine mounts
3. Factors affecting thrust/torque.
4. The purpose and advantages of modular construction.
5. Common designs of turbine engines including:
   - Torque producing engines - • turboshaft and turboprop
   - Thrust producing engines • turbojet and turbofan
6. The principles of noise suppression techniques.
7. Turbine engine systems including fuel, lubrication, ignition, air exhaust.

Describe:

8. Common turbine engine terminology and acronyms.

11.2 Ignition

Explain:

1. Types and operation of turbine engine ignition systems and their components including:
   - low tension (glow plugs)
   - high tension (capacitive discharge)
   - auto re-light.
2. Turbine engine ignition system safety precautions

11.3 Starting

Explain:

1. Design and components of starting systems.

2. The operation of various turbine engine starters including air turbine starters, electrical starters, (motor and starter-generator).

3. Inspection and servicing procedures for starting systems.

4. The operation of an auto-start system.

11.4 Engine Indicating Systems

Explain:

1. Principles and operation of engine indicating systems including:

- speed indication
- temperature indication
- pressure indication
- flow metering systems.
- quantity indication (oil quantity)
- fault detection (chip detector, filter bypass)
- power indication systems engine pressure ratio (EPR)
- torque indication
- status enunciators
- built in test equipment (BITE) system
- vibration indication

11.5 Turbine Engine Safety

Explain:

1. Safety precautions and hazards while ground running including:

- foreign object ingestion
- jet/prop blast
- turbine burst
- personnel,
- noise
- hazards created by deviation from procedures (integrated systems)
- aircraft restraint (chocks, tie downs, etc.)

12.0 PROPELLERS and SYSTEMS

Explain:

1. Theory and design of aircraft propellers including:

- forces acting on a propeller
- lift and angle of attack
- propeller construction materials

2. Fixed pitch, controllable pitch, constant speed, feathering and reversing propellers.

13.0 HYDRAULIC POWER

Explain:

1. Safety precautions, including high pressure bottles and accumulators.
2. Fluid dynamics, types of fluid and system components.
3. System design including multiple and integrated systems and system redundancy.
4. System maintenance.

14.0 PNEUMATIC POWER

Explain:

1. The differences between hydraulic and pneumatic systems.
2. The principles of operation, maintenance and servicing of a pneumatic system components including:
   - temperature regulation
   - pressure control
   - flow control
   - sources
   - common applications

15.0 AIRCRAFT PLUMBING

Explain:

1. The standard fittings and hardware identification systems.

16.0 LANDING GEAR

Explain:

1. The various types and configurations of landing gear assemblies including shock absorbing and non-shock absorbing systems.
2. The purpose and operation of shimmy dampers.
3. The operation of components of landing gear retraction and anti-retraction systems.
4. The operation and components of hydraulic and mechanical, emergency extension systems.
5. Various brake types.
6. Anti-skid and skid warning systems.
7. Basic, boosted, power, automatic and emergency braking systems and components.

8. Brake indicating systems including break wear and temperature indication.

9. Mechanical and powered steering systems.

10. The purpose of air ground sensing systems.

17.0 ENVIRONMENTAL CONTROL SYSTEMS

Identify:

1. Air sources for cabin pressurization.

Explain:

2. Fundamentals of heating, cooling and ventilation systems and their components including:

- air cycle machine
- heat exchangers
- vapour cycle cooling
- exhaust type heaters
- bleed air heating
- combustion type heaters

3. Electrical/electronic equipment cooling systems.

4. Cabin pressure fundamentals and components including system safety precautions and functional tests.

5. The various oxygen system fundamentals and component operation including:

- solid state/chemical oxygen
- liquid oxygen
- gaseous oxygen

18.0 FUEL

Explain:

1. Fuels - types, properties and additives.

2. Airframe fuel system configurations and component functions including:

- storage
- venting
- jettison
- grounding
- distribution
- indication

19.0 ICE AND RAIN PROTECTION

Explain:

1. Causes and types of ice formation.

2. Types of ice detection systems.

3. Anti-ice and de-ice systems and principles of operation including:

- propeller/rotor
- powerplant (air inlets, external sensors, fuel heaters)
- windshields
- air data gathering devices
- vents and drains
- airframe surfaces
- water/waste systems

4. Rain repellent systems.

20.0 EMERGENCY SYSTEMS

Identify:

1. The types and operation of emergency lighting systems.

2. The types and operation of emergency evacuation slides and rafts.

3. The types of ELTs including Underwater Locating Devices.

Explain:

4. Requirements and procedures for inspecting, installing and testing of ELTs.

5. Emergency breathing apparatus.

20.1 Fire Protection

Describe:

1. Various types of aircraft fire detection systems e.g. spot detectors, continuous loop, infra-red and ultra-violet.

2. Various types of suppression and extinguishing systems and safety precautions including aircraft installed and portable.

21.0 MAINTENANCE PROCEDURES

Explain:

1. Inspection and maintenance requirements for private and commercial aircraft as outlined in the *Canadian Aviation Regulations*.

2. Fundamentals and types of aircraft inspections including:

- periodic, annual and approved maintenance schedules
- abnormal occurrence (hard landing, lightning strike, etc.)

- special (Airworthiness Directive or Service Bulletin)

3. Weight and balance procedures and requirements including:

- jacking
- leveling
- weighing
- installed equipment list
- weight and balance report
- amendment requirements
- regulatory requirements

4. Differences between fixed and rotary wing aircraft weight and balance procedures, e.g. Lateral center of gravity.

5. Fundamentals of quality assurance.

Perform:

6. A weight and balance procedure on an aircraft, including associated documentation.

7. Completion of documentation of maintenance records including:

- technical records
- defect lists
- technical reports
- service difficulty reporting

8. Computerized information input and retrieval.

9. Tasks utilizing Minimum Equipment Lists, Configuration Deviation Lists and built in test equipment programs.

22.0 IMPERIAL and RELATED UNITS

Perform

1. Calculation including conversions using:

- Length: feet, inches, statue mile, nautical mile
- Velocity: feet/sec., miles/hr., knots
- Weight/Mass: pounds, ounces
- Volume: pints, quarts, imperial gallons, U.S. gallons
- Temperature: Fahrenheit, Celsius, Rankine, Calvin

23.0 DC THEORY

Explain:

1. DC theory.

2. Electron theory.

3. Magnetism.

4. Potential difference and capacitance.
5. Current and resistance.
6. Electrical measurements.
7. Sources of electrical energy.
8. Magnetic effects of electric current.
9. Inductance fundamentals.
10. Direct current generators and motors.
11. Synchros (synchronous transmitters, receivers and resolver).
12. Tranducers.
13. DC CCTs and analysis.

Identify:

14. Sources of electrical energy.
15. Direct current measuring devices.

Describe:

16. Electrical switches.

24.0 AC THEORY

Explain:

1. Alternating current (AC) theory.
2. AC generators, motors and transformers - theory.
3. Synchros (synchronous transmitters, receivers and resolver) .
4. Transducers.
5. RCL\RC\RL circuits.
6. Resonant circuits.
7. Capacitance fundamentals.

Identify:

8. AC measuring devices.
9. Vacuum tube devices.

25.0 ANALOG THEORY

Explain:

1. Semiconductor devices.
2. Semiconductor - theory.
3. Diodes.
4. Transistors.
5. Power supplies.
6. Rectification.
7. Filtering.
8. Regulation.
9. Controls.

26.0 DIGITAL THEORY PRINCIPLES

Explain:

1. Integrated circuits (LSI, CMOS).
2. Special application IC's.
3. Pulse techniques.
4. Pulse parameters.
5. Pulse modulation (PAM, PWM, RPM, PCM).
6. Multivibrators (monostable, astable, bistable).
7. Boolean algebra.
8. Basic laws and expressions.
9. Numbering systems.
10. Decimals.
11. Binary.
12. Hexadecimal.
13. Octal.
14. Conversions.
15. Binary computations.
16. Digital electronics techniques.

17. Logic gates (AND, OR, Invert, NAND, NOR, COMP).
18. Application of logic gates (Decoder, AD/DA, Multiplexing).
19. Application of basic digital/microcomputer technology.
20. Microprocessors/data transfer between systems.
21. Summing amplifiers (operational amplifiers).
22. Differentiators.
23. Integrators.
24. Servo loops.
25. Application of control systems e.g. powerplant, flight control, landing gear.
26. Integrated circuits (LSI, CMOS).
27. Special application IC's.

Perform:

28. Binary computations and conversions.

27.0 MAINTAIN COMMUNICATION SYSTEMS

Identify:

1. ELTs.
2. Radio antennas.
3. H.F. communications.
4. VHF communications.
5. SELCAL.

Describe:

6. Acceptable standards.

Explain:

7. Radio - theory.
8. Amplifiers.
9. Oscillators.
10. Filters.
11. Mixers.

12. Modulation.
13. Radio antennas.
14. Radio transmitters and receivers.
15. Troubleshooting techniques.
16. Remote Radio Channeling.
17. Digital communications
18. H.F. communications.
19. VHF communications.
20. SELCAL
21. Interphone, including, flight , service, audio Integration.
22. Passenger entertainment (Multiplex audio and video).
23. Air/Ground radio telephone.
24. ELTs - Sat Comm.
25. Aircraft systems troubleshooting, including:
    - ramp testing and troubleshooting communication equipment
    - locating and repairing predetermined faults

Perform:

26. Installation of avionics systems including:
    - equipment tray
    - wire installation
    - antenna installation
    - Line Replaceable Unit
27. Electrical load analysis.
28. Weight and balance amendment.
29. Maintenance release/Conformity Certificate.
30. Technical records entries.
31. Functional check of H.F. communications, VHF communications systems.

Test, Troubleshoot, Repair, Adjust, Remove and Replace:

32. ELTs.
33. Radio antennas.
34. H.F. communications.

35. VHF communications .

28.0 MAINTAIN NAVIGATION SYSTEMS

Describe:

1. Acceptable standards.

Explain:

2. Navigation principles.

3. Navigation antennas.

4. Standard practices.

5. Flight Management Systems.

6. Inertial Navigation Systems.

7. Inertial Reference.

8. Radio navigation:

- ADF
- VOR
- Localizer
- Glide Slope
- Marker Beacon
- Horizontal Situation Indicator/R.M.I
- Area Nav

9. LORAN.

10. Hyperbolic navigation principles.

11. Global Positioning Systems.

12. Aircraft system troubleshooting including:

- ramp testing and troubleshooting navigation equipment
- locating and repairing predetermined faults

Test, Troubleshoot, Repair, Adjust, Remove and Replace:

13. The following systems, including its associated antennas:

- ADF
- VOR
- Localizer
- Glide Slope
- Marker Beacon
- Horizontal Situation Indicator/R.M.I.
- Area Nav.
- Global Positioning Systems

Perform:

14. Avionics system equipment tray installation.
15. Wire installation.
16. Antenna installation.
17. Installation of Line Replaceable Unit.
18. Electrical load analysis.
19. Weight and balance amendment.
20. Maintenance release/Conformity Certificate.
21. Technical records entries.

29.0 MAINTAIN PULSE SYSTEMS

Explain:

1. Radar navigation systems including:
   - introduction to microwave principles and pulse techniques
   - weather radar
   - DME interrogator
   - ATC transponder
   - TCAS
   - Radio altimeter (LRRA)
   - Doppler principles
   - GPWS
2. Troubleshooting Aircraft Systems, including:
   - ramp test and troubleshoot pulse systems
   - locate and repair predetermined faults
3. Avionics system installation, including:
   - equipment tray installation
   - wire installation
   - antenna installation
   - Line Replaceable Unit.

Test, Troubleshoot, Repair, Adjust, Remove and Replace:

4. Radar navigation systems, including:
   - weather radar
   - DME interrogator
   - ATC transponder
   - Radio altimeter (LRRA)

30.0 MAINTAIN AUTO FLIGHT CONTROL SYSTEMS

Explain:

1. Introduction and system overview of:
   - yaw damper system
   - flight director
   - autopilot
   - speed command
   - auto throttle
   - standard practices
   - VNAV
   - Stability Augmentation System

2. Aircraft systems troubleshooting, including:
   - ramp testing and troubleshooting of auto flight equipment
   - locating and repairing faults

31.0 MAINTAIN ELECTRICAL SYSTEMS

Explain:

1. Proper use of test equipment to support curriculum.
2. Wiring practices, including wire and co-axial cable specifications (MIL and FAA) .
3. Drawing and schematic symbology.
4. Bonding EMI/RFI suppression techniques.

Perform:

5. Wire stripping.
6. Soldering/de-soldering.
7. Crimping methods (various).
8. Splicing techniques (various).
9. Looming procedures.
10. Plugs, receptacles and connectors procedures.

11. Physical protection devices techniques.
12. Potting techniques.
13. High reliability techniques.
14. Routing/lacing/clamping techniques.
15. Wire identification.
16. Wire selection.
17. Electrical load analysis.
18. Weight and balance amendment.
19. Maintenance release/conformity certificate.
20. Technical records entries.
21. Controls (voltage regulators and protection devices).

Troubleshoot Aircraft Systems including:

22. Ramp test and troubleshoot electrical systems.
23. Locate and repair predetermined faults.
24. Service batteries.
25. Test DC generation, including controls (voltage regulators and protection devices) and inverters.
26. Label, test, troubleshoot and repair:
    - AC generation:
    - introduction
    - alternators (AC. generators)
    - DC generation:
    - introduction
    - generators
    - installation of:
      - electrical system wires
      - components
      - batteries

Describe:

27. Electrical system installation including acceptable standards.
28. Electrical power systems monitoring devices.

32.0 MAINTAIN INSTRUMENT SYSTEMS

Describe:

1. Acceptable standards.

Explain:

2. Air data systems and instrumentation, including:
   - pitot and static system check
   - central air data computing system
   - air data instruments (MACH/IAS, VSI/IVSI, BARO ALTM)
   - air temperature instruments
   - mach-airspeed warning

3. Attitude and direction, including:
   - introduction to gyroscopic and flux valve principles
   - gyrosyn compass system/magnetic compass
   - attitude reference systems
   - turn and bank/turn coordinator/slip indication
   - standby artificial horizon
   - laser gyro
   - attitude director indicators
   - video displays
   - EFIS

4. Flight Data and Voice Recorder, including:
   - system requirement
   - system operation and testing
   - Underwater Acoustic Beacon operation and testing

5. Compass swing.

6. Data bus systems.

7. The Installation of instrument system including:
   - equipment installation
   - wire installation

Perform:

8. Electrical load analysis (if applicable).

9. Weight and balance amendment.
10. Maintenance release/Conformity Certificate.
11. Journey and technical log entries.
12. Compass swing.
13. Installation of instrument system including equipment and wire installation.

Test, troubleshoot, repair, adjust, remove and replace:

14. Ramp test and troubleshoot instrument systems.
15. Locate and repair predetermined faults.
16. Air Data Systems and instrumentation, including:
    - pitot and static system and check
    - Air Data Instruments (MACH/IAS, VSI/IVSI, BARO ALTM).
    - Central Air Data Computing system
    - Gyrosyn compass system/magnetic compass.

Appendix C - Part 4
Curriculum and Topic Guides
Aircraft Structures Maintenance Training Standard
(amended 1999/12/01)

1.0 SAFETY

Identify:

1. Potential health hazards.

2. Potential fire hazards.

3. Types and classes of fires.

Apply: (to comply with standard)

4. Workplace Hazardous Materials Information System (WHMIS).

5. Use of Material Safety Data Sheets (MSDS).

6. Local governmental safety regulations.

7. Company safety regulations.

8. Use of personal safety equipment.

9. Use of protective clothing.

10. The Workers' Compensation Board (WCB) reporting procedures for personal injuries.

11. The effects of human factors contributing to maintenance errors.

2.0 REGULATION and DOCUMENTATION

Explain:

1. The purpose of the Advisory Material (AMA) sheets.

2. The purpose of an aircraft journey log.

3. The purpose of an aircraft technical records.

4. The purpose of a Type Certificate Data Sheet (TCDS).

5. The purpose of a Supplemental Type Certificat (STC).

6. The Repair Design Certificate (RDC) process.

7. Privileges of an Approved Maintenance Organization (AMO).

8. Delegated authority.

9. The legal and moral responsibilities of maintenance technicians and ames.
10. The definition of specialized maintenance.

Apply: (to comply with standard)

11. Applicable sections of the *Canadian Air Regulations* (cars).
12. Applicable sections of the *Airworthiness Manual* (AWM).
13. Technical records entry procedures following repairs or modifications.

3.0 TECHNICAL INFORMATION

Review:

1. The Air Transport Association Specification No. 100 (A.T.A. Spec. No. 100 System).
2. The General Aviation Manufacturers Association (GAMA) Specification No. 2.
3. Maintenance Manuals (MM).
4. Illustrated Parts Catalogs (IPC).
5. Structural Repair Manuals (SRM).
6. The FAA Manual AC-43.13 (USA).
7. The Military Specifications (MIL-Specs) (USA).
8. The National Aeronautical Standards (NAS) (USA).
9. Service Bulletins (sbs).
10. Alert Service Bulletins (ASBs).
11. Shop records, work orders or similar documentation.
12. Technical drawings.
13. Aircraft hardware standards, i.e. AC, AN, MS, NAS and Manufacturer's standards.
14. The Society of Automotive Engineers (SAE) Aeronautical Material Specifications (AMS).
15. Equipment manufacturers' specifications.

4.0 GENERAL

Explain:

1. English measurement system.
2. Shop mathematics.
3. Basic physics.
4. Aircraft on ground (AOG) priority procedures.

5. North American drafting standard (third-angle projection).
6. World drafting standard (first-angle projection)
7. Title blocks.
8. List of materials.
9. Notes and specifications.
10. Revision and application blocks.
11. Fastener codes.
12. Types of projections, i.e. Perspective, orthographic and isometric.
13. Schematic diagrams.
14. Lines used in drawings.
15. Dimensions and tolerances.

Perform:

16. Blueprint reading.
17. Drawing shop sketches.
18. Storing and handling of aircraft materials.

5.0 AIRCRAFT SYSTEMS

Explain:

1. Fixed and rotary wing theory of flight
2. Aircraft flight control systems
3. Aircraft propulsion systems
4. Hydraulic and pneumatic systems
5. Landing gear systems
6. Environmental systems
7. Ice protection systems
8. Fire protection systems
9. Emergency systems

6.0 TOOLS and EQUIPMENT

Utilize:

Hand tools such as:

1. Measuring devices.
2. Approved marking methods.
3. Lay-out devices, i.e. templates.
4. Lights and mirrors.
5. Clamping devices.
6. Cutting tools, i.e. saws. files, shears, reamers, chisels, scrapers etc.
7. Boring tools, i.e. drill bits, countersinks, counterbores, fly cutters.
8. Abrasives.
9. Punches.
10. Hole finders.
11. De-burring tools.
12. Chassis punches.
13. Hammers and mallets.
14. Pliers.
15. Sidecutters.
16. Screwdrivers.
17. Internal wrenching tools.
18. Open-end and box wrenches.
19. Socket wrenches.
20. Torque-limiting wrenches.
21. Special wrenches, i.e. ratcheting box wrench, flare-nut wrenches.
22. Safety-wire twisters.
23. Cotter pin pullers.
24. Sealing guns.
25. Suction cups.
26. Tube benders.

27. Tube beaders.

    Machine tools such as:

28. Portable drill motors.
29. Drill presses.
30. Routers.
31. Ketts saws.
32. Jigsaws.
33. Grinders.
34. Dimpling machines.
35. Beading machines.
36. Foot and power squaring shears.
37. Throatless shears.
38. Bench bending brakes.
39. Press brakes.
40. Punch presses.
41. Slip-roll formers.
42. Wheeling machines.
43. Flanging machines.
44. Power planishing hammers.
45. Shrinkers and Stretchers.
46. Band saws.
47. Cut-off saws.
48. Pneumatic rivet guns.
49. Blind rivet pullers.
50. Portable and fixed rivet squeezers.
51. Pneumatic squeeze guns.
52. Pneumatic broach guns.
53. Rivet shavers.

54. Spot welders.
55. Tube bending machines.
56. Hot bonders.
57. Sanders.
58. Table (bench) saw.
59. Jointer.

7.0 AIRFRAME STRUCTURES and DESIGNS

Explain:

1. Types and missions of fixed and rotary wing aircraft.
2. Major assembly breakdown of fixed and rotary wing aircraft.
3. Forces acting on an aircraft in flight and on the ground.
4. Truss type fuselage construction.
5. Monocoque and semi-monocoque type fuselage construction.
6. Types of wing and rotor arrangements and construction.
7. Types and arrangements of landing gears.

8.0 STRUCTURAL MATERIALS

Identify:

1. Ferrous metals.
2. Non-ferrous metals.
3. Types of composites.
4. Composite materials.
5. Aircraft quality wood.
6. Wrought aluminum alloys.
7. Titanium alloys.
8. Monel.
9. Stainless steel.
10. Chrome-molybdenum steel.
11. Superalloys (high temperature).
12. Markings on ferrous and non-ferrous sheet metal.

13. Markings on ferrous and non-ferrous tubing.

9.0 HEAT TREATMENT

Explain:

1. Solution heat treatment.
2. Precipitation heat treatment.
3. Quenching.
4. Natural aging.
5. Artificial aging.
6. Normalizing.
7. Annealing.
8. Hardening.
9. Tempering.
10. Work hardening.

10.0 CORROSION CONTROL

Identify:

1. Causes of corrosion.
2. Locations susceptible to corrosion.
3. Surface corrosion.
4. Intergranular corrosion.
5. Exfoliation.
6. Stress corrosion.
7. Dissimilar metal (galvanic) corrosion.
8. Concentration cell corrosion.
9. Fretting corrosion.
10. Magnesium corrosion.
11. Filiform corrosion.
12. Nickel and chrome plating processes.
13. Galvanizing

14. Metal spray coating.
15. Metal cladding.
16. Anodizing.
17. Corrosion removal methods on high-strength steel.
18. Acceptable cleaning processes.

Apply:

19. Conversion coatings.
20. Primers and paints.
21. Water displacing compounds.
22. Leveling compounds.
23. Sacrificial anodes.

Perform:

24. Mechanical corrosion removal, i.e. abrasive blasting.
25. Chemical treatment of corroded areas.
26. Polishing of metal surfaces.

11.0 DAMAGE ASSESSMENT

Explain:

1. Scanning and detail inspection.
2. Limitations of liquid penetrant testing.
3. Magnetic testing.
4. Radiography (X - Ray).
5. Ultrasonic testing.
6. Eddy-current testing.
7. Infrared thermography.
8. Lifting and shoring procedures.
9. Impact damage and force travel.
10. Fire damage indications.

Perform:

11. Corrosive substances inspections, i.e. mercury and acids.

12. Lightning strike inspections.
13. Abnormal flight load inspections.
14. Heavy landing and tail strike inspections.
15. Bird strike inspections.
16. Aging aircraft checks (SSID).
17. Composite delamination inspections.

12.0 SHEET METAL REPAIRS

Describe:

1. Acceptable methods, techniques, and practices from AC 43.13.
2. Inspection for repair or replacement assessment.
3. Support of aircraft components during repair, i.e. Jigs or fixtures.
4. Selection of acceptable repair material.
5. Permissible fastener edge distance margins.
6. Minimum and maximum fastener spacing in pitch and gauge.
7. Acceptable oversizing of fastener holes.
8. Minimum allowable sheet thickness for countersinking.
9. Calculation of number of fasteners required using the rivet formulae.
10. Minimum bend-radii.
11. Acceptable rivet dimensions after bucking.

Apply:

12. Alignment check procedures during repairs.
13. Aerodynamic smoothers.
14. Sealing compounds.
15. Corrosion inhibiting primers.

Perform:

16. Removal of rivets and special fasteners.
17. Removal of damaged parts.
18. Stop-drilling of cracks.

19. Deburring of sheet metal edges.
20. Cutting of corner radii.
21. Calculation of bend allowances.
22. Fastener hole preparations, i.e. pre-drilling, reaming and broaching (cold working).
23. Locating of blind holes.
24. Driving and bucking of solid rivets.
25. Installation of blind rivets and bolts.
26. Installation of bolts, washers and nuts.
27. Skin repairs with surface and flush patches.
28. Repairs by splicing.
29. Installation of doublers.
30. Corrugated skin repairs.
31. Re-balancing of control surfaces after repairs.
32. Return to service inspections.

13.0 STANDARD and SPECIAL FASTENERS

Identify:

1. Standard aircraft screws.
2. Standard aircraft bolts.
3. Special (Manufacturer's) aircraft bolts.
4. Special blind bolts.
5. Standard aircraft plain and locking nuts.
6. Special aircraft nuts, i.e. Tinnerman, anchor, blind nuts, etc.
7. Plain and special aircraft washers.
8. Locking devices, i.e. cotter pins, locking wire.
9. Straight and taper pins.
10. Standard solid aircraft rivets.
11. Special blind rivets.
12. Panel and cowling fasteners.

14.0 Composite Repairs

Explain:

1. Personal hygiene protection methods specific to composites.
2. Personal protection devices.
3. Absence of universal repair standards.
4. Fiber materials, i.e. glass, aramid, graphite, carbon, boron, metal.
5. Warp and woof (A.K.A. fill or weft) threads.
6. Lay-up warp clock.
7. Types of fabric weaves.
8. Unidirectional fibbers.
9. Honeycomb core materials.
10. Solid core materials.
11. Foam core materials.
12. Cold curing and thermosetting matrix resins.
13. Damage assessment methods, i.e. coin tapping, ultrasonic, radiography, thermography, acoustic emission.
14. Repair or replacement evaluation.
15. Manufacturer's specified repair methods, i.e. riveted patches, cold/hot-bonding, autoclave.
16. Repair resins (matrix materials).
17. Manufacturer's specified core filling limits.
18. Pre-impregnated fabrics (B - State).

Perform:

19. Delamination detection by coin tapping.
20. Vacuum bagging.
21. Hot bonding.
22. Delamination repairs.
23. Routing with templates.
24. Core replacement repairs with honeycomb or balsa wood.
25. Core replacement repairs with syntactic foam.

26. Core replacement repairs with microballoons.

27. Removal of entrapped water.

28. Surface scratch removal.

29. Priming and painting.

30. Cleaning and polishing.

31. Re-balancing of control surfaces after completed repairs.

15.0 TUBULAR REPAIRS (welding excluded)

Identify:

1. Acceptable methods, techniques, and practices from AC 43.13.

2. Inspection methods for internal corrosion.

3. Steel parts that are not permitted to be repaired by welding.

4. Support of tubular structure for repair, i.e. holding fixtures and jigs.

5. Acceptable replacement materials.

6. Cold-straightening limits for bent tubing.

7. Repair or replacement evaluation.

Apply:

8. Internal corrosion protection oils or water displacing compounds.

9. External corrosion protection primers and paints.

Perform:

10. Cold removal of dents in thin walled steel tubing.

11. Removal of damaged tubing.

12. Cutting and fitting for splicing of replacement tubes by inner-sleeve and outer-sleeve method.

13. Cutting of scarf joints.

14. Cutting of fishmouth joints.

15. Drilling for rosette welds.

16. Fabrication of surface patches for dents or holes.

17. Fabrication of finger patches for cluster repairs.

18. Alignment checks.

16.0 WOOD REPAIRS

Identify:

1. Acceptable methods, techniques, and practices from AC 43.13.
2. Acceptable solid aircraft woods.
3. Acceptable aircraft plywoods.
4. Acceptable defects in aircraft woods.
5. Limitations on spar repairs.
6. Visual inspection procedures.
7. Stress inspection procedures.
8. Visual indications of decay, i.e. dry-rot.
9. Indications of separated glue joints.
10. Indications of deteriorated glue joints.
11. Causes of cracks, i.e. checks, shakes, splits.
12. Causes of compression failure.

Apply:

13. Doublers and re-enforcement plates.
14. Bonding agents (glues).
15. Wood sealers by brushing or spraying.

Perform:

16. Cutting of scarf joints.
17. Acceptable glue joint surface preparation.
18. Splicing of solid wood members, i.e. spars, ribs.
19. Plywood skin repairs, i.e. overlay, splayed, plug, and scarf patches.
20. Re-finishing of repaired wood structures.

17.0 FABRIC REPAIRS

Explain:

1. Acceptable organic fabrics and grades.
2. Acceptable inorganic (synthetic) fabrics and grades.
3. Traditional methods of attaching fabric, i.e. rib-stitch, screws, blind rivets, clips.

4. Methods of re-covering components, i.e. envelope.
5. Acceptable coating materials (dopes), i.e. nitrate, butyrate.
6. Purpose of fungicidal additives.
7. Acceptable solvents and thinners.
8. Purpose of retarders.
9. Causes of blushing.
10. Methods of ultraviolet-ray (UV) protection.
11. Purpose of rejuvenators.
12. Approval requirements (STC) for proprietary covering materials.
13. Causes of fabric deterioration.
14. Visual indications of fabric coating deterioration, i.e. peeling, ring-worms.
15. Methods of testing fabric strength.
16. Repair or replacement evaluation.

Apply:

17. Proprietary coating materials by brushing and spraying.
18. Reinforcing and surface tapes.
19. Primers and paint.

Perform:

20. Testing of fabric covered aircraft components with hand testing equipment, i.e. seyboth, maule.
21. Machine sewing of fabric panels.
22. Doped-on panel repairs.
23. Sewn-in patch repairs.
24. Fabric rejuvenation procedures.
25. Shrinking of synthetic fabric by heating.
26. Installation of grommets and inspection rings.

18.0 SHEET METAL FABRICATION

Explain:

1. Protection of sheet metal from damage during production.
2. Transfer of measurements from sample or technical drawing.

3. Lay-out procedures.
4. Flat pattern lay-out.
5. Templates.
6. Drilling jigs and assembly fixtures.

Perform:

7. Sheet metal cutting by hand and machine cutters.
8. Punch press operation for blanking of sheet metal.
9. Routing of sheet metal blanks.
10. Drilling or punching of relief holes.
11. Edge deburring procedures.
12. Sheet metal bending with hand and power brakes.
13. Rolling of sheet metal with hand and power slip rollers.
14. Joggling of flat sheets and flanges.
15. Shrinking and stretching of flanged sheet metal.
16. Forming of sheet metal with rubber punch press.
17. Forming of sheet metal with stretch press.
18. Forming of sheet metal with wheeling machines.
19. Sheet metal bumping.

19.0 COMPOSITE FABRICATION

Explain:

1. Master mould construction methods.
2. Autoclave curing procedures.
3. Curing steps and cycles.
4. Mould removal methods.

Apply:

5. Mould polishes.
6. Mould release agents.
7. Ultraviolet ray (UV) protection.

8. Lightning strike protection, i.e. metal spray, discharge devices.

Perform:

9. Edge trimming of cured composites.

10. Final inspections.

11. Priming and painting.

20.0 FLUID LINES and CONDUITS

Explain:

1. Fluid lines identification codes.

2. Pressure, return, breather and drain lines.

3. Rigid fluid lines (pipes).

4. Semi-rigid fluid lines (tubes).

5. Acceptable pipe and tubing materials.

6. Minimum bend allowance for thin walled tubing.

7. Acceptable bend distortion limits.

8. Standard threaded pipe and tube fittings.

9. Acceptable flaring angles.

Perform:

10. Tube and pipe cutting.

11. Bending of thin walled tubing using distortion limiting materials, i.e. sand, rosin or bending alloys.

12. Bending of thin walled tubing using distortion limiting devices, i.e. mandrels, coil springs or bending blocks.

13. Bending of thin walled tubing using hand benders.

14. Bending of thin walled tubing using bending machines.

15. Swaging of fittings.

16. Selection and attaching of flared fittings.

17. Flaring using single-flare method.

18. Flaring using double-flare method.

19. Pressure testing of completed assemblies.

20. Drilling of drain holes in conduits.

21. Beading of breather or drain lines

21.0 THERMOPLASTICS

Identify:

1. Acceptable transparent thermoplastic materials.

Explain:

2. Inspection of installed windows and lenses with prisms.
3. Installation precautions for plastic windows and lenses.
4. Repair or replacement evaluation.
5. Storage and surface protection.
6. Cleaning/buffing procedures and precautions.

Perform:

7. Cutting of various plastic materials.
8. Gluing of various plastic materials.
9. Heat treatment of plastic glue joints.
10. Cold and hot forming of plastic windows and lenses.
11. Drilling with special drill bit angles.
12. Crack repairs.
13. Hole repairs.
14. Installations of plastic windows and lenses.

Transport Canada / Transports Canada

TP 6197E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

STANDARD 571 - MAINTENANCE

Canada

Available through your local book seller or by mail from
Canadian Government Publishing
Communication Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Fax: (613) 954-5779 or 1-800-661-2868
Orders only: 1-800-635-7943
Internet: http://publications.communication.gc.ca

Catalogue No.: T51-15/571-2008E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2008-2 (2008/12/30)	[illegible]	
2009-1 (?)	" "	
2009-2 (2009/12/01)	"	
2010-2 ([illegible])	" "	

Date of Amendment	*Date Entered*	*Entered by*

STANDARD 571 - MAINTENANCE

Table of Contents

PART V - AIRWORTHINESS

STANDARD 571 - MAINTENANCE

571.01 *Application*

Reserved

571.02 *Maintenance and Elementary Work Performance Rules*

(amended 2002/09/01)

Information Note:

Section 571.02 of the Canadian Aviation Regulations *(CARs) is applicable to the performance of maintenance or elementary work. It addresses how work should be done, as opposed to what work should be done. For example, required contents of a maintenance schedule, or approval of design data, are not covered by that section but are addressed in Subpart 605 and Subpart 521 of the CARs respectively.*
(amended 2009/12/01)

Persons who perform maintenance or elementary work are required to follow the manufacturer's recommendations or equivalent practices. Where the recommendations of the aircraft manufacturer are incompatible with those of the engine, propeller or appliance manufacturer, the recommendations of the aircraft manufacturer shall be used. Where the manufacturer has not made specific recommendations, standard industry practices are to be used. These practices include, but are not limited to, methods published by Transport Canada, a foreign Civil Aviation Authority, the manufacturer of a similar product or other practices that may not be published provided they are generally accepted by the Canadian aviation industry. Similar requirements apply to the selection of parts, materials, tools and test apparatus.

Information Note:

Subsection 571.02(3) of the CARs requires that persons who perform specified tasks meet the personnel qualification or training standards applicable to the performance of those tasks.

571.03 *Recording of Maintenance and Elementary Work*

Information Note:

Compliance with section 571.03 of the CARs is the responsibility of the person performing the work. This regulation is applicable to the making of an entry into a technical record, which is distinct from the maintenance release addressed by section 571.10 of the CARs.

(1) A person who performs maintenance or elementary work on an aeronautical product shall ensure that the following information is recorded in the technical records, established in accordance with Subpart 605 of the CARs, for the aeronautical product:

Information Note:

Appendix A of Standard 625 - Aircraft Equipment and Maintenance lists the tasks and conditions associated to elementary work and section 605.94 of the CARs requires that all tasks designated as elementary work be recorded in the journey log.

(a) product identification (aircraft registration marking, nomenclature, type/model number, name of manufacturer, part number, and serial number), unless the entry is being made in technical record that contains this information;

(b) a brief description of the work performed;

(c) where a standard other than the manufacturer's recommended practice is being used, reference to the standard used in the performance of the work;

Information Notes:

(i) If manufacturer's instructions are being followed and there is no optional method provided to perform the work, it is not necessary to state the standards that were used to perform the work. In cases where optional methods can be used, the method chosen shall be referenced. In cases where damage is being assessed, the extent of the damage and the associated reference to manufacturer's limitations shall be referenced.

(ii) If this entry constitutes the maintenance release, ensure that the date on which the work was performed is indicated, and that all other requirements of section 571.10 and section 605.93 of the CARs are complied with.

(d) the date on which the maintenance was performed and the identification of the employee who accomplished the task;

(e) where the maintenance involves a repair that includes making and installing repair parts in accordance with subsection 571.06(4) of the CARs, a statement to that effect;

(f) where disassembly is required during performance of work, a general description of any defect found prior to re-assembly;

(g) where a task is partially completed, a general description of any outstanding work, including the specific location of any parts/systems that have been disturbed, is to be recorded. Where the open work lists, inspection sheets or job cards used to accomplish the work clearly indicate any outstanding work, they are acceptable for meeting this requirement; and

(h) where the part has been accepted pursuant to Appendix H of this standard, a statement indicating that it has been inspected and tested to ensure it conforms to its type design and is in a safe condition, and a maintenance release has been issued to that effect.
(amended 2002/03/01)

571.04 *Specialized Maintenance*

For the purpose of this section, the following definition applies:

"an AMO category appropriate to the work performed" - means a category, issued pursuant to subsection 573.02(3) of the CARs, identifying the product being maintained or the process being performed.

Information Notes:

(i) The provision of section 571.04 of the CARs applies to persons performing specialized maintenance, not to those persons who certify the performance of that work. Section 571.11 of the CARs addresses the certification of maintenance.

(ii) Processes, specifically welding and nondestructive testing, and aeronautical products for which an AMO Certificate can be issued are listed in section 573.02 of Standard 573.

(iii) In the case of engine overhaul, an AMO with only an engine category can perform the overhaul, provided that any specialized NDT/welding forming part of the overhaul is carried out by an AMO approved for those processes.

(iv) For clarification purposes, an aircraft engine "crankcase" does not include a reduction gear case or an accessory case.

(v) In the case of avionics, standard test equipment refers to test equipment intended primarily for on-aircraft use that provides go/no-go or numerical indications that do not require subjective interpretation on the part of the user. Standard test equipment includes, but is not limited to: multi-meters, direct reading gauges, pitot static test sets, fuel system capacitance test sets, dead weight testers, land compass, and ramp checking equipment.
(amended 2003/06/01)

(vi) In the case of Avionics Specialized Maintenance:
(amended 2003/06/01)

(a) "Avionics Systems" refers to equipment and systems of the kinds listed in subsection 573.02(4) of standard 573.

(b) "Instruments" includes Engine Monitor Systems, Fuel Flow Systems, and other types of stand-alone instrumentation.

(c) "Standard Test Equipment" refers to test equipment of the type(s) defined in Note (v) above.

(d) Equivalency of LRUs with hardware (Part Number) and/or software status changes is verified by the aircraft or the equipment manufacturer's service instructions.

571.05 *Maintenance of Aeroplanes or Helicopters Operated Pursuant to Part IV of the CARs or Aircraft Operated Pursuant to Part VII of the CARs*

Information Note:

Aeroplanes or helicopters used by approved flight training units (FTUs) are operated pursuant to Part IV of the CARs, while aircraft used commercially are operated pursuant to Part VII of the CARs. Section 571.05 of the CARs is applicable to the performance of maintenance on such aircraft, or on parts installed on such aircraft.

Maintenance of aeronautical products installed on aeroplanes or helicopters operated pursuant to Part IV of the CARs or aircraft operated pursuant to Part VII of the CARs shall be performed under the control of an AMO approved pursuant to section 573.02 of the CARs. Maintenance of parts, prior to installation on an aircraft operated under Parts IV or VII of the CARs, can be performed outside an AMO, provided the work is subject to a maintenance arrangement made pursuant to section 573.11 of the CARs.

571.06 *Repairs and Modifications*

(1) The following definitions apply to this section:

"major modification" - as per the definition found in Subpart 101 of the CARs.
(amended 2000/12/01)

Information Note:

For convenience, the Subpart 101 definition is reproduced here.

"major modification" - means an alteration to the type design of an aeronautical product in respect of which a type certificate has been issued that has other than a negligible effect on the weight and centre-of-gravity limits, structural strength, performance, power plant operation, flight characteristics or other qualities affecting its airworthiness or environmental characteristics; (modification majeure)
(amended 2009/12/01)

"major repair" - as per the definition found in Subpart 101 of the CARs.
(amended 2000/12/01)

Information Note

For convenience, the Subpart 101 definition is reproduced here.

"major repair" - means a repair to an aeronautical product in respect of which a type certificate has been issued, that causes the aeronautical product to deviate from the type design defined by the type certificate, where the deviation from the type design has other than a negligible effect on the weight and centre-of-gravity limits, structural strength, performance, power plant operation, flight characteristics or other qualities affecting the aeronautical product's airworthiness or environmental characteristics;(réparation majeure)
(amended 2009/12/01)

"acceptable data" - includes:

(a) drawings and methods recommended by the manufacturer of the aircraft, component or appliance;

(b) Transport Canada advisory documents;

(c) advisory documents issued by foreign airworthiness authorities with whom Canada has entered into airworthiness agreements or memoranda of understanding such as current issues of Advisory Circular 43.13-1 and -2 issued by the FAA, Civil Aviation Information Publications (CAIPs) issued by the Civil Aviation Authority (CAA) of the United Kingdom, Advisory Circular, Joint (ACJs) issued by the Joint Aviation Authority (JAA) or Acceptable Means of Compliance (AMC) issued by the European Aviation Safety Agency

(EASA); and,
(amended 2009/12/01)

(d) drawings and methods found appropriate by a delegate in conformity with paragraph 4.2(o) and subsection 4.3(1) of the *Aeronautics Act. (données acceptables)*
(amended 2009/12/01)

"approved data" - includes:

(a) type certificates, supplemental type certificates, part design approvals, Canadian technical standard order (CAN-TSO) design approvals or repair design approvals, including equivalent foreign documents which have undergone the type design examination process set-out in Subpart 521 of the CARs or are otherwise accepted in Canada; and
(amended 2009/12/01)

(b) other drawings and methods approved by the Minister or a delegate in conformity with paragraph 4.2(o) and subsection 4.3(1) of the *Aeronautics Act. (données approuvées)*
(amended 2009/12/01)

"specified data" - is information contained in authoritative documents which, although not approved by the Minister, has been specified by the Minister as appropriate for the purpose of major modifications and major repairs, in conformity with section 571.06 of the CARs. The following are examples of specified data:
(amended 2000/12/01)

(a) drawings or methods described or referenced in Airworthiness Directives;

(b) data issued by the manufacturer or type certificate holder of the aircraft, component or appliance, such as modification orders, service bulletins or engineering orders, which include a statement of approval by the applicable regulatory authority or a delegated representative of such an authority. Where the data issued by the aircraft manufacturer are incompatible with those of the component or appliance manufacturer, the data of the aircraft manufacturer shall prevail;

(c) manufacturer's Structural Repair Manuals;

(d) FAA Advisory Circulars AC 43.13-1 and AC 43.13-2, subject to the following conditions:

(i) the aircraft is a small aircraft and the alteration does not affect dynamic components, rotor blades, structure that is subject to pressurization loads or the primary structure of a rotorcraft;

(ii) the alteration does not affect an existing limitation (including the information contained on mandatory placards) or change any data contained in the approved sections of the Aircraft Flight Manual, or equivalent;

(iii) the data are appropriate to the product being altered and are directly applicable to the alteration being made; and,

(iv) the data are not contrary to the aircraft manufacturer's data. *(données specifies)*
(amended 2009/12/01)

(2) The criteria to be used to determine which data applies to modifications and repairs is as follows:

(a) All major modifications and major repairs shall be performed in accordance with either "approved" data or "specified" data. A statement of "No technical objection", or similar wording, by the manufacturer does not constitute "approved", "acceptable", or "specified" data and shall not be used without further approval by the Minister.

(b) All other modifications and repairs shall be performed in accordance with "acceptable" data.

Information Note:

Additional guidance for the classification of modifications and repairs can be found in Appendix A of this standard.

(3) Where, pursuant to subsection 571.06(1) of the CARs, a major modification or a major repair is required to be performed in conformity to the applicable technical data and a deviation from specified and/or approved data has occurred, the major modification or major repair shall be subject to re-approval.
(amended 2000/12/01)

(4) Subsection 571.06(1) of the CARs prescribes that the person who performs a major repair or major modification or signs a maintenance release in respect of this modification or repair shall ensure that the technical data used is applicable. Therefore, prior to certification, the person certifying the aforementioned modification or repair shall ensure that any deviation from the original documents is approved.

(5) The person certifying a repair or the incorporation of a modification which includes the making and installing of a part must ensure that the following standards of airworthiness have been complied with:

(a) except as provided in paragraphs (b) and (c), all repair parts must conform with the applicable type design data. Where documents such as Maintenance Manuals, Structural Repair Manuals, or other service information do not provide all of the information required to fully describe the attributes of the part, it is necessary to obtain a copy of the manufacturer's drawings and all associated specifications;

(b) No repair part made under these provisions shall be marked with the part number specified in the type design;

Information Notes:

(i) The provisions of subsection 571.06(4) of the CARs prohibit that a "made" part be marked with the part number specified in the type design, or that the "made" part be offered for sale. Persons making and installing these parts cannot record that the original part was repaired, but shall state that the part was replaced with a made repair part. The individual will not be authorised to state that a new part has been installed, as a "new" part will require a release under Subpart 561 of the CARs manufacturing approval.

(ii) Subpart 561 of the CARs, to be published in the near future, will prescribe the requirements for the approval of manufacturers of aeronautical products. In the interim, the requirements of Chapter 561 of the Airworthiness Manual in effect up to the publication of Subpart 561 of the CARs continue to apply.

(c) Subject to subsection (6), where parts are no longer in production by the manufacturer of the part, or an authorised representative, and the type design data for the part is not available, the design data used for the making of the part may be established by inspecting and testing to determine the correct:

(i) materials;

(ii) dimensions;

(iii) hardness and temper;

(iv) surface finish; and

(v) protective coatings.

(6) Where the repair part constitutes a portion of the primary structure of the aeronautical product, the design data developed in accordance with paragraph (5)(c) above shall be approved pursuant to subsection 571.06(1) of the CARs.

(7) Where, because a modification authorises repetitive re-configurations of an aircraft, separate flight authorities have been issued under Subpart 507 of the CARs, the responsibility for determining which flight authority is in effect with respect to the aircraft rests with the person who carries out the re-configuration of the aircraft. In most cases the person will be an AME. However, where the reconfiguration only involves elementary work, it may be the authorised signatory of an air operator, or a private aircraft owner/operator.

Information Notes:

(i) If the person reconfiguring the aircraft is unsure of the effect of the reconfiguration, the approved data for the modification should be consulted for guidance.

(ii) This section is not meant to address aircraft operations such as slinging external loads. Flight restrictions for this type of activity are established via the operational rules of Parts VI and VII of the CARs.

571.07 *Installation of New Parts*

Information Note:

The definitions of 'commercial part' and 'standard part' set out in Subpart 101 of the CARs apply to this Standard and are reproduced below for convenience only.
(amended 2002/03/01)

"commercial part", in respect of an aircraft, means a part
(amended 2002/03/01)

(a) that is not specifically designed or produced for use as an aeronautical product,

(b) that is made to a specification or catalogue description and marked under an identification scheme of the maker, and

(c) whose failure does not adversely affect the continued safe flight and take-off and landing of the aircraft; (pièce commerciale)

"standard part", in respect of an aircraft, means a part manufactured in conformity with a specification that
(amended 2002/03/01)

(a) is established, published and maintained by an organization setting consensus standards or by a government agency, and

(b) includes design, manufacturing, test and acceptance criteria and identification requirements; (pièce standard)

The standards of airworthiness applicable to the installation of new parts are as follows:

(a) The requirements detailed in section 571.13 of this standard are met;

Information Note:

Parts and bulk materials provided under this provision do not require an airworthiness certification, but must be identified or be identifiable, through a part number, shipping document, etc.

(b) Parts that were not originally intended for aeronautical use (e.g. automotive voltage regulators, electronic components, air filters), providing the original manufacturer's part number is shown in the parts list of the next or subsequent higher assembly. Where the original manufacturer's part number is not shown in a parts list, other data authorised by type design, such as data approved under a supplemental type certificate are to be consulted. (amended 2009/12/01)

Information Note:

(i) The person installing a replacement electronic component is responsible for ensuring that the replacement part meets the correct tolerance required by the type design. This information can usually be obtained from either a colour code or markings on the original part or the illustrated parts catalogue of a higher assembly.

(ii) The part may be:
(amended 2002/03/01)

(a) a standard electrical or electronic part that requires additional processing before it can be used in the intended application;

(b) produced in conformance with a specification published and maintained by a consensus standards organization, a government agency, a holder of a type certificate or in conformance with the manufacturer's internal specifications and standards. (amended 2009/12/01)

(iii) The specification may include manufacturing controls, quality and reliability test methods, acceptance criteria and identification requirements. It does not include electrical parameters and test methods which are obtained from the supplier's data sheet. The part is used within the manufacturer's published operating characteristics and environmental

ranges.
(amended 2002/03/01)

(c) Parts produced pursuant to an FAA Parts Manufacturer approval (PMA) are eligible for installation on a Canadian aircraft or on an aeronautical product intended for installation on a Canadian aircraft provided that:
(amended 2009/12/01)

(i) the parts are marked in accordance with the part marking requirements set out by the FAA; and
(amended 2009/12/01)

(ii) the parts are accompanied by an authorized release certificate which certifies the parts conform to the applicable design data approved by the FAA or the Minister and indicates the aeronautical product for which they are eligible.
(amended 2009/12/01)

Information Note:

Used FAA PMA parts are to comply with the requirements for installation of used parts in accordance with section 571.08 of the CARs.
(amended 2009/12/01)

(d) Parts manufactured in conformity with a part design approval issued by the Minister are eligible for installation on a Canadian aircraft or on an aeronautical product intended for installation on a Canadian aircraft.
(amended 2009/12/01)

571.08 *Installation of Used Parts*

(1) The standards of airworthiness applicable to the installation of used parts are as follows:

(a) the requirements detailed in section 571.13 of this standard are met;
(amended 2002/03/01)

(b) except as provided in (2), used parts shall be accompanied by a maintenance release;

Information Note: *The maintenance release is to cover any maintenance performed on the part including, at least, inspection of the part to verify that it conforms to its approved configuration and is in a safe condition.*
(amended 2007/12/30)

(c) the document bearing the maintenance release shall be examined to see if any additional maintenance tasks are required upon installation, and those tasks shall be completed. The maintenance release for the installation of the part includes the release for these tasks.

(2) No maintenance release document is required where the part is an airworthy part that has been removed from an aircraft and installed on another aircraft with no intervening storage period. The identification of the aircraft from which the part was removed, and any other details necessary to establish the technical history of the part, shall be entered in the recipient aircraft's technical record.

(3) Where a part has been removed for troubleshooting purposes and is subsequently found not to be the cause of the reported problem, details of the reported problem and the method of eliminating the part as a cause of that problem shall be recorded on the documentation accompanying the part, and certified by means of a maintenance release.
(amended 2007/12/30)

Information Note: *Section 571.13 of the CARs stipulates that if a part is removed from an aeronautical product that is damaged or permanently withdrawn from service, that part is to have a known origin and, as such, be traceable to the manufacturer certificate holder or to an approved aeronautical product, and is to be inspected in accordance with the pertinent instructions for continuing airworthiness (ICA) or approved data.*
(amended 2002/03/01)

571.09 *Installation and Disposal of Life - Limited Parts*

(amended 2002/03/01)

Pursuant to section 571.09 of the CARs, life-limited parts and assemblies incorporating life-limited parts shall:
(amended 2002/03/01)

(a) have a technical history that includes the total time in service of the life-limited part; and

(b) be installed in accordance with section 571.13 of this standard.

Information Notes:
(amended 2002/03/01)

(i) The technical history, referred to in (a), may be limited to providing the traceability of the part to the previous airframe, engine, propeller, appliance, or component from which it was removed, or from which the technical history was obtained.

(ii) For the purpose of this provision, the total time in service of the part is the number of hours, cycles, landings, calendar time or combination thereof, whichever is applicable to the limitation placed on the life of the part, since its initial installation following its manufacture.

(iii) The requirements in respect of the disposal of life-limited parts that have reached their time in service set out in section 571.09 of the CARs.

571.10 *Maintenance Release*

Information Note:

Pursuant to section 605.85 of the CARs, where an aircraft has undergone maintenance, a maintenance release with respect to maintenance performed shall be completed prior to take off in the affected aircraft. It is a declaration that, with respect to the maintenance performed, the performance rules of section 571.02 of the CARs have been complied with and the applicable standards of airworthiness have been met.
(amended 2002/03/01)

(1) For the purpose of this section the following definitions apply:

"under the person's supervision" – refers to the person who, by way of the organisation chart or assignment of responsibilities in an approved manual, exercises supervisory authority over a person making a maintenance release.
(amended 2007/12/30)

"similarly worded statement" - means any statement that can be interpreted as conveying the meaning of the maintenance release statement of subsection 571.10(2) of the CARs. This statement may be omitted when the Technical Record, established pursuant to section 605.92 of the CARs, clearly indicates that a signature in a specified signature block constitutes a maintenance release.
(amended 2007/12/30)

Information Note*: For example, a FAR 43.9 approval for return to service issued in compliance to an agreement between Canada and the USA constitutes a similarly worded statement and has the same meaning as a maintenance release.*
(amended 2007/12/30)

(2) Maintenance Release Record Keeping

(a) A maintenance release applies only to the particular maintenance task or tasks to which it relates. Therefore:

(i) it is acceptable to sign a maintenance release in respect of a single task or group of tasks, even if other work is outstanding on the aircraft, provided that the wording of the entry leaves no doubt as to the scope of work being certified; and

(ii) it is the responsibility of the person signing a maintenance release to ensure that the technical record is correct in respect of the status of any outstanding task.

(b) Each maintenance release must include the following information:

(i) product identification (aircraft registration marking, nomenclature, type/model number, name of manufacturer, part number, and serial number), unless the release is being made in an established Technical Record that contains this information;

(ii) a brief description of the work performed, including applicable reference data, when the reference data is not included in the maintenance publications of the manufacturer, and the work order number; and

(iii) where a part that has been accepted pursuant to Appendix H of this standard, a statement included in the certification documents, providing as follows:
(amended 2002/03/01)

"This part has been determined to conform to the approved type design, or to be acceptable under section 571.13 of the CARs".

(c) The maintenance release shall contain a statement indicating when an airworthy part was removed from an aircraft.
(amended 2007/12/30)

(d) Where a maintenance release is made using an "Authorized Release Certificate" (Form One), Appendix J would normally apply.
(amended 2008/12/30)

***Information Note:** Appendix J to this standard contains information to complete Form One, respecting certification of new and used aeronautical products, other than complete aircraft.*
(amended 2008/12/30)

(e) Where a maintenance release is made under the authority of an AMO it must include the identification of both the signatory and the AMO. Identification of the signatory may be either by AME licence number, or by other means that clearly identifies the signatory within that organisation.

(f) Where a maintenance release is made by a person holding a restricted certification authority (RCA) issued pursuant to section 571.11 of the CARs, the number of that authority must be entered.
(amended 2000/12/01)

(3) Responsibility for compliance with airworthiness directives (ADs) is assigned to the owner of the aircraft in accordance with section 605.84 of the CARs.

Information Notes:

(i) Some inspection check sheets contain a check box with a statement to the effect that "...all applicable ADs have been complied with". Such a statement transfers this responsibility to the AME signing the maintenance release for the inspection, even though it may be impractical for the AME to undertake the level of research required. Since compliance with ADs are the responsibility of the owner, AMEs should strike out this item on the inspection check sheets that they sign.

(ii) If the owner wishes to have this research undertaken by the AME as a separate maintenance task, it can be raised as a separate item on the work order, work card, or other document detailing the maintenance arrangement.

(4) Notwithstanding the requirement to comply with the Performance Rules in accordance with section 571.02 of the CARs, the following additional standards of airworthiness, developed in conformity with section 571.10 of the CARs, apply with respect to the types of work indicated in the following table [redacted]
[redacted]

Types of Work
([redacted])

(refer to section 571.10 of the standard)

Types Of Work	Applicable Standards Of Airworthiness
(a) Work for which a personal qualification or training standard has been established.	That the work has been performed by a person who holds the personal qualifications or training standards, required by subsection 571.02(3) of the CARs.
(b) Specialized Maintenance	That the work was performed under the control of an organisation approved for the applicable category pursuant to section 571.04 of the CARs. (amended 2002/09/01)

Types Of Work	Applicable Standards Of Airworthiness
(c) Nondestructive Testing (NDT) ***Information Note:*** *Where NDT has been performed, but where the inspection findings have not yet been assessed against the published limits, a maintenance release shall not be signed in respect to the NDT requirement. Hence, a maintenance release is only required where disassembly and reassembly were involved to provide the access necessary for the inspection.*	That the inspection findings have been analysed and any defect or discontinuity noted in the inspection findings, supplied by the person performing the NDT, is within the manufacturer's published limits for that aeronautical product.
(d) Work that disturbs engine or flight controls	That the system has been inspected for correct assembly and correct locking of any parts disturbed by the maintenance performed, including an operational check for proper sense and range of motion of the engine or flight controls has been accomplished, by at least two persons, and the technical record contains the signatures of both persons. (amended 2010/12/30) ***Information Note:*** *One of the signatures required by this section may be that of the person who has signed the maintenance release.*
(e) Functional, Operational or other Ground Test (i.e. Where specified in the quality procedures of the organization performing the work, or where the person signing the maintenance release determines that a functional, operational, or other ground test is required to verify satisfactory completion of the work).	A test shall be performed prior to signing a maintenance release or conditional maintenance release, demonstrating that the aeronautical product is functioning in accordance with the applicable design standards.
(f) Test Flights & Conditional Maintenance Releases (i.e. Where specified in the quality procedures of the organisation performing the work, or where the person signing the maintenance release determines that a test flight is required to verify the system operation). ***Information Note:*** *Conditional Maintenance Releases are not to be used in those instances where maintenance personnel require additional information as to system operation or other operational characteristics (e.g. report on the range of a navigational system, cabin temperature control, etc.)*	(i) That all applicable ground testing has been satisfactorily completed; and, (ii) That the Journey Log provides details which describe the verification test required by the pilot, including any specific test requirements. ***Information Note:*** *Subsection 605.85(3) of the CARs addresses the pilot's requirements for log entries following a test flight.*

Types Of Work	Applicable Standards Of Airworthiness
(g) Maintenance performed with respect to an Airworthiness Directive (AD).	That the record made with respect to the AD includes: (i) the identification code or number used by the issuing authority for that AD (where an organisation uses internal document bearing an alternative identification code or a number to control the compliance with the requiremnts of an AD, that number must also be shown in the maintenance release); (ii) where the AD specifies alternative requirements, the identification of the alternative used; (iii) where the AD is a multi-part AD, the identification of the parts of the directive that have been complied with; and, (iv) where an AD requires an inspection, the findings resulting from that inspection have been noted in the technical record.
(h) Weight & Balance (W&B): (i) Change to empty weight or centre of gravity (C of G) position, including lateral C of G where limitations are published; (ii) W&B Report.	(i) The revised empyt weight and C of G position shall be calculated, and the weight & balance report, established pursuant to section 605.92 of the CARs shall be reissued or amended. (ii) The report meets the standards established in conformity with section 571.10 of the CARs and contained in Appendix C.
(i) Opening & Closing Pressure Systems (positive or negative pressure), other than opening by means of - a quick-disconnect, - a self-sealing drain valve; - an oil or fuel fill/servicing cap	(i) The pressure system is tested, inspected, and found to be properly connected and within leakage tolerances specified in the regulations, standards, or the aeronautical product manufacturer's specifications, as applicable; and, (ii) Where the work is performed on an altimeter or pitot-static system, the leak check outlined in Appendix B shall be complied with in conformity with section 571.10 of the CARs. ***Information Note***: *In the case of the pitot-static system, only a leak check is required at this time. The full calibration cycle tabled in Appendix B is only required at the 2 year interval tabled in the Aircraft Equipment and Maintenance Standards (625).*
(j) Work affecting performance of a Magnetic Direction Indicator (MDI), including installation of a replacement indicator.	The MDI shall be calibrated and, in the case of non-stabilised direction magnetic compasses, a new correction card installed.

Types Of Work	Applicable Standards Of Airworthiness
(k) Propeller Inspection	The standards of airworthiness specified in Appendix D shall be complied with in accordance with section 571.10 of the CARs.
(l) Wooden Component Inspection (excluding wooden propeller)	The standards of airworthiness specified in Appendix E shall be complied with in accordance with section 571.10 of the CARs.
(m) Work affecting performance of Transponder or Altitude Reporting Systems	The standards of airworthiness specified in Appendix F shall be complied with in accordance with section 571.10 of the CARs.
(n) Work affecting performance of Emergency Locator Transmitter (ELT)	The standards of airworthiness specified in Appendix G shall be complied with in accordance with section 571.10 of the CARs.
(o) Cockpit Voice Recorder (CVR) & Underwater Locator Device (ULD) Maintenance	The standards of airworthiness as specified in Standard 625 Appendix C. (amended 2007/12/30)
(p) Flight Data Recorder (FDR) & Underwater Locator Device (ULD) Maintenance	The standards of airworthiness as specified in Standard 625 Appendix C. (amended 2007/12/30)
(q) Recurring Defect Rectification	The person signing the Maintenance Release has reviewed the methodology used in previous repair attempts, to determine if the current rectification methodology is appropriate.
(r) Cycles, landings or hours since new of a life-limited part.	The cycles, landings or hours recorded on the maintenance release represent the total accumulated cycles, landings or hours since the time of manufacture of the part.
(s) Cockpit Voice Recorder intelligibility check.	A test procedure shall be established which, when completed under operational conditions, will enable verification of intelligible recorded audio information from all the various input sources required by the regulations: (i) at intervals specified in the applicable maintenance standards; or, (ii) upon initial installation. ***Information Notes***: *i) Care must be exercised when determining running hours. Some systems are such that the CVR is on at any time power is applied to the aircraft; in this case the factor identified in the manufacturer's specifications shall be applied to determine the running time. As an example, one CVR manufacturer recommended a factor of 1. 7*

Types Of Work	Applicable Standards Of Airworthiness
	times flight hours. Where no factor is provided, each installation will have to be evaluated individually paying due regard to such details as running time meters, etc. *(ii) The escalation of the maintenance times is permitted when proposed as an amendment to an air operator's maintenance schedule and when substantiated with reliability statistics.*
(t) Work affecting static ports, pitot tubes and flight control surfaces. (amended 1998/06/01)	That the work has been performed and inspected to ensure: - critical sensors such as static ports or pitot tubes, which may affect aircraft flight characteristics, are not blocked; - movement of flight control surfaces is not impeded. (amended 1998/06/01) Any installation of control locks, gear pins, static port covers and pitot tube covers are to be marked, or identified, by a high visibility colour, and that warning flag has been securely attached. (amended 1998/06/01)
(u) Certification of undocumented parts. (amended 2002/03/01)	That the work has been performed under the control of an approved maintenance organization holding a certificate that specifies the applicable category for which pertinent ratings have been issued, indicated in section 573.02 of Standard 573, in accordance with the process outlined in Appendix H of this standard. (amended 2002/03/01)
(v) Liquid penetrant inspection. (amended 2002/09/01)	ASTM E 1417 - *Standard Practice for Liquid Penetrant Examination.* (amended 2002/09/01)

Types Of Work	Applicable Standards Of Airworthiness
(w) Hydrostatic testing of pressure vessels. (amended 2002/09/01)	National Standards of Canada: CAN/CSA B339-96; and CAN/CSA B340-97 Testing to be performed in accordance with the Canadian Standards listed herein by a Canadian organization approved under the *Transportation of Dangerous Goods - Regulations*. (amended 2002/09/01)

571.11 *Persons Who May Sign a Maintenance Release*

Information Notes:

(i) Section 571.11 of the CARs authorises the holder of an Aircraft Maintenance Engineer (AME) licence with a rating appropriate to the product being maintained to sign any maintenance release.

(ii) To establish what is an appropriate rating, consult Standard 566.

(1) Maintenance performed in a State that is a party to an agreement with Canada, shall be certified by either the holder of a Canadian AME licence, a person who has been authorised under the laws of that State, or a person whose knowledge is determined to be equivalent to the holder of an AME licence pursuant to Subpart 403 of the CARs, as described in subsection (2). Where that work is performed by a foreign maintenance organisation, the maintenance release must be signed by persons qualified pursuant to the local regulations and authorised by the foreign maintenance organisation.

Information Notes:

(i) In order to determine if a state is a party to an agreement with Canada, and to establish whether an agreement applies in a particular case, consult the following internet site: www.tc.gc.ca/CivilAviation/Certification/menu.htm.

(ii) In addition to providing information concerning aircraft maintenance, some of these agreements also have territorial restrictions. For example, the Bilateral Airworthiness Agreement between Canada and the U.S., is only applicable to work performed in the United States, including Alaska, Hawaii, and Puerto Rico. Under the terms of the bilateral agreement, use of FAA Part 145 "foreign" Repair Stations located elsewhere is not authorised.

(2) For the purpose of executing a maintenance release on Canadian aircraft, bilateral agreements between Canada and another State only have effect within the territory of that State except where:

(a) the agreement specifically provides for such work;

(b) the person certifying the work is working for an organisation that is under the jurisdiction of the state with whom Canada has entered into the agreement; and,

(c) the work is not taking place within the boundaries of another State with whom Canada has entered into an arrangement.

(3) Application for a restricted certification authority (RCA) is to be made through the local Transport Canada Center (TCC).
(amended 2000/12/01)

Information Note: *The local TCC is the one having jurisdiction over the geographical area within which the applicant's approved organization is situated.*
(amended 2000/12/01)

(4) On receipt of the application from the responsible TCC, and where the conditions set out in section 571.11 of the CARs have been met, the RCA shall be issued. The RCA shall include the validity period and the scope of work for which it is issued.
(amended 2000/12/01)

Information Note: *Unwillingness on the part of an RCA applicant to pay the remuneration requested by a suitably rated AME who is willing to certify the maintenance, does not constitute valid justification to grant an RCA. The fact that an AMO does not have a suitably endorsed AME on staff is not sufficient justification for issuance of an RCA, if a qualified AME is available in the area.*
(amended 2000/12/01)

(5) For the purposes of these standards, the Minister has determined that, in respect of the certification of parts, persons authorised by members of the International Airlines Technical Pool have an equivalent knowledge to that of an AME licensed pursuant to Subpart 403 of the CARs.

571.12 *Reporting of Major Repairs or Major Modifications*
(amended 2002/09/01)

(1) A major repair or a major modification shall be reported to the Minister by means of a Major Repair or Major Modification Report in accordance with the specifications set out in Appendix L to this standard.
(amended 2002/09/01)

Information Notes:
(amended 2002/09/01)

(i) In conformity with the classification conditions set out in section 571.06 of this standard, examples of reportable major repairs and major modifications could include: spar repair or modification; repair or modification of pressurized fuselage; deviation in configuration from type certification basis; any maintenance that results in an acoustical change; installation of an aeronautical part or equipment that has been subjected to a major repair and or major modification.

(ii) The FAA requires that where a major repair or major modification has been accomplished in Canada on aircraft of United States registry, completion of an FAA Form 337 is required.

(iii) Where a major repair or major modification has been accomplished in the United States on aircraft of Canadian registry, an FAA Form 337 may be provided in lieu of a Major Repair or Major Modification Report.

(2) If major repairs and major modifications are accomplished in accordance with specified data, the information required in the "Description of Work Accomplished" block on the report shall identify the specific data references, for example as found in FAA AC43.13-1, or -2, or both, together with specific reference to the appropriate manufacturer's installation instructions. A statement such as "performed in accordance with AC43.13-2 and manufacturer's installation instructions" is not acceptable.
(amended 2002/09/01)

(3) If major repairs and major modifications are accomplished in accordance with the specified data derived from the design approval holder's instructions for continued airworthiness, or from FAA Advisory Circular AC43.13-1, the "Description of Work Accomplished" block shall identify the specific pages, paragraphs, and figures referred to in FAA AC43.13-1, together with the critical dimensions, materials, locations, and processes. This procedure is also applicable to major repairs accomplished in accordance with specified data derived from Structural Repair Manuals. General statements, such as, "performed in accordance with AC43.13-1" are not acceptable.
(amended 2002/09/01)

571.13 *Installation of Parts (General)*

The following definition applies to this Standard:
(amended 2002/03/01)

"undocumented part" means a part lacking sufficient certification or history to make it eligible for installation on an aircraft without submitting it to a recertification process. (*pièce sans appui documentaire*)

Information Note: *Pursuant to section 571.13 of the CARs, a part is to be inspected and its accompanying documentation verified prior to installation in accordance with a procedure that the Minister finds acceptable, having regard for the safety of the aircraft, to ensure that the part conforms to its type design. In the case of components removed from an aircraft for repair, overhaul or exchange, traceability to their most recent airworthy installation or to their most recent maintenance action will constitute evidence of conformity to type design.*
(amended 2002/03/01)

Pursuant to section 571.13 of the CARs and subject to sections 571.07, 571.08 and 571.09 of the CARs, the following standards of airworthiness are applicable to the installation of a part:

(a) except in the case of aircraft that are operated pursuant to a special certificate of airworthiness in the owner-maintenance or amateur-built classification, only parts that are specified in the type design of an aeronautical product or that are approved alternative parts, are eligible for installation in that product;
(amended 2007/12/30)

***Information Note**: An approved alternative part may be a replacement part that has been given either Part Design Approval (TCCA PDA) by Transport Canada or a Parts Manufacturer Approval (FAA PMA) by the Federal Aviation Administration.*
(amended 2007/12/30)

(b) where a type certificate holder assigns a proprietary number during the design phase to a standard or commercial part, and the proprietary part number is the only part number shown in the parts catalogue or similar document, only a part bearing the type certificate holder's proprietary number, or an approved alternative part, shall be installed;
(amended 2007/12/30)

***Information Notes**:*

(i) In some cases, the type certificate holder of an aeronautical product will, through the part number contained in the parts catalogue, add a suffix or a prefix to what appears to be a standard industry part. Where this has occurred, the modified part number is accepted as proprietary to the aeronautical product type certificate holder, and the installation of the standard or commercial part is not permitted without an appropriate engineering approval as a modification.
(amended 2002/03/01)

(ii) In many cases, the illustrated parts catalogue may contain a standard or commercial part number. This may be especially true in the case of bearings and electronic components. Standard and commercial parts having the identical part number may be installed regardless of the part manufacturer.
(amended 2002/03/01)

(c) substitution of equivalent standard or commercial parts is permitted only when the substitution does not constitute a major modification in accordance with section 571.06 of the CARs. Substantiation requires that the characteristics of the substituted part meet or exceed, all of the requirements of the type design of the part being replaced. Reliance on substitution guides alone is not considered adequate. The evaluation of the characteristics of that part is subject to a review of specific type certificate holder's data, such as technical drawings, specification sheets or substantiation reports associated with that type design;
(amended 2002/03/01)

(d) the part to be installed must be correctly configured for the installation in the aeronautical product; and

(e) prior to installation, the part should be inspected to ensure that it corresponds with its documentation, there are no signs of obvious damage, corrosion or deterioration, and the shelf life, where applicable, has not been exceeded.

Information Note:

A person who has reasonable grounds to believe that a part installed or intended for installation in a type certified aeronautical product that was not manufactured or certified in accordance with the applicable regulations of the state of production, or that is improperly marked, or that is documented in such a manner as to mislead with regard to the origin, identity or condition of the part shall submit to the Minister a report of the suspected unapproved part, using the service difficulty reporting system set out in section 521.401 of the CARs.

(amended 2009/12/01)

APPENDIX A - CRITERIA FOR THE CLASSIFICATION OF MODIFICATIONS AND REPAIRS

(1) **General**

The following criteria outline a decision process for assessing the classification of a modification or repair.

Information Note:

For each issue it shall be determined whether the modification or repair to be accomplished could have other than a negligible effect on those characteristics contained in the definitions of "Major Modification" and "Major Repair", pursuant to section 571.06 of this standard. The following questions are answered with either a YES or NO response. A YES answer to any individual question indicates that the modification or repair shall be classified major.

(2) **Criteria**

(a) **Operating Limitations**

Does the modification or repair involve a revision in the operating limitations specified in the approved type design?

(b) **Structural Strength**

Information Note:

The questions contained in this paragraph shall be applied to alterations of an airframe, engine, propeller, or component.

Does the modification or repair alter:

(1) a principal component of the aircraft structure such as a frame, stringer, rib, spar, skin or rotor blade?

(2) a life-limited part or a structural element that is subject to a damage tolerance assessment or fail-safe evaluation?

(3) the strength or structural stiffness of a pressure vessel?

(4) the mass distribution in a structural element?

Information Note:

This might involve the installation of an item of mass that would necessitate a structural re-evaluation.

(5) a containment or restraint system intended for occupants or the storage of items of mass (e.g. cargo)?

(6) the structure of seats, harnesses, or their means of attachment?

(c) **Powerplant Operation**

Does the modification or repair:

(1) affect the power output or control qualities of the powerplant, engine, propeller, or their accessories?

(2) alter the approved operating limitations?

(d) **Performance and Flight Characteristics**

Does the modification or repair involve alterations that:

(1) significantly increase drag or exceed aerodynamic smoothness limits?

(2) significantly alter thrust or power output?

(3) affect stability or controllability?

(4) induce flutter or vibration?

(5) affect the stall characteristics?

(e) **Other Qualities Affecting Airworthiness**

Does the modification or repair:

(1) change the information on, or the location of, a placard required by the type design or an Airworthiness Directive?

(2) alter any information contained in the approved section of the aircraft flight manual or equivalent publication?

(3) affect the flight-crew's visibility or their ability to control the aircraft?

(4) affect egress from the aircraft?

(5) reduce the storage capacity of an oxygen system, or alter the oxygen rate of flow?

(6) affect flight controls or an autopilot?

(7) alter an electrical generation device, or the electrical distribution system between the generating source and either its primary distribution bus, or any other bus designated as an essential bus?

Information Note:

The electrical distribution system includes its associated control devices, and all its protection devices.

(8) reduce the storage capacity of the primary battery?

(9) affect a communication system required by the approved type design?

(10) affect instruments, or indicators that are installed as part of a system required by the approved type design?

(f) **Other Qualities Affecting Environmental Characteristics**

Does the modification or repair increase aircraft noise levels or emissions?

(amended 2002/06/01)

APPENDIX B - ALTIMETER SYSTEM TEST AND INSPECTION

The standards of airworthiness applicable to the performance of an altimeter or altimeter system test and inspection are:

(a) For static pressure systems:

(1) the system is free from moisture or sources of restriction;

(2) the static port heater, if installed, is operative;

(3) there is no alteration or deformity of the airframe surface that would affect the relationship between air pressure in the static pressure system and true ambient static air pressure under any flight condition; and

(4) the leakage rate of the system shall not exceed the following tolerances:

(i) for unpressurized aircraft, where the static pressure system is evacuated to a pressure differential of approximately 1 inch of mercury, or to a reading on the altimeter 1000 feet above the aircraft elevation at the time of test, without additional vacuum applied for a period of 1 minute, the loss of indicated altitude must not exceed 100 feet on the altimeter.

(ii) for pressurised aircraft, where the static pressure system is evacuated until a pressure differential equivalent to the maximum cabin pressure differential for which the aircraft is type certified, without additional vacuum applied for a period of 1 minute, the loss of indicated altitude must not exceed 2 percent of the altitude equivalent to the maximum permitted cabin differential pressure, or 100 feet, whichever is greater.

(b) For an altimeter:

(1) Test by an approved maintenance organisation in accordance with the following. Unless otherwise specified, each test for performance may be conducted with the instrument subjected to vibration.

(i) Scale Error

With the barometric pressure scale at 29.92 inches of mercury, the altimeter shall be subjected successively to pressures corresponding to the altitude specified in Table I, up to the maximum normally expected operating altitude of the aircraft in which the altimeter is to be installed. The reduction in pressure shall be made at a rate not in excess of 20,000 feet per minute to within approximately 2,000 feet of the test point. The test point shall be approached at a rate compatible with the test equipment. The altimeter shall be kept at the pressure corresponding to each test point for at least one minute, but not more than ten minutes, before a reading is taken. The error at all test points must not exceed the tolerances specified in Table I.

(ii) Hysteresis

The hysteresis test shall begin not more than 15 minutes after the altimeter's initial exposure to the pressure corresponding to the upper limit of the scale error test prescribed in subparagraph (i); and while the altimeter is at this pressure the hysteresis test shall commence. Pressure shall be increased at a rate simulating a descent in altitude at the rate of 5,000 to 20,000 feet per minute until within 3,000 feet of the first test point (50 percent of maximum altitude). The test point shall then be approached at a rate of approximately 3,000 feet per minute. The altimeter shall be kept at this pressure for at least 5 minutes, but not more than 15 minutes, before the test reading is taken. After the reading has been taken, the pressure shall be increased further, in the same manner as before, until the pressure corresponding to the second test point (40 percent of maximum altitude) is reached. The altimeter shall be kept at this pressure for at least one minute, but not more than 10 minutes, before the test reading is taken. After the reading has been taken, the pressure shall be increased further, in the same manner as before, until atmospheric pressure is reached. The reading of the altimeter at either of the two test points shall not differ by more than the tolerance specified in Table II, from the reading of the altimeter for corresponding altitude recorded during the scale error test prescribed in subparagraph (i).

(iii) After Effect

Not more than 5 minutes after the completion of the hysteresis test prescribed in subparagraph (ii), the reading of the altimeter (corrected for any change in atmospheric pressure) shall not differ from the original atmospheric pressure reading by more than the tolerance specified in Table II.

(iv) Friction

The altimeter shall be subjected to a steady rate of decrease of pressure approximating 750 feet per minute. At each altitude listed in Table III, the change in reading of the points after vibration shall not exceed the corresponding tolerance specified in Table III.

(v) Case Leak

The leakage of the altimeter case, when the pressure within the case corresponds to an altitude of 18,000 feet, shall not change the altimeter reading by more than the tolerance shown in Table II, during an interval of one minute.

(vi) Barometric Scale Error

At constant atmospheric pressure, the barometric pressure scale shall be set at each of the pressures (falling within its range of adjustment) that are listed in Table IV, and shall cause the pointer to indicate the equivalent altitude difference shown in Table IV, with a tolerance of 25 feet.

(2) Altimeters which are of the air data computer type with associated computing systems, or which incorporate internally air data correction, shall be tested and inspected in parts or by major components to specifications developed by the manufacturer.

(c) **Records**

Comply with Subpart 571 of the CARs as to content, form, and disposition of records. The person performing the altimeter tests shall record on the altimeter the date and maximum altitude to which the altimeter has been tested and the person signing the maintenance release shall enter that data in the aircraft record.

Table I

Altitude (feet)	Equivalent pressure (inches of mercury)	Tolerance ± (feet)
-1,000	31.018	20
0	29.921	20
500	29.385	20
1,000	28.856	20
1,500	28.335	25
2,000	27.821	30
3,000	26.817	30
4,000	25.842	35
6,000	23.978	40
8,000	22.225	60
10,000	20.577	80
12,000	19.029	90
14,000	17.577	100
16,000	16.216	110
18,000	14.942	120
20,000	13.750	130
22,000	12.636	140
25,000	11.104	155
30,000	8.885	180
35,000	7.041	205
40,000	5.538	230
45,000	4.335	255
50,000	3.425	280

Table II - Test Tolerance

(amended 2007/12/30)

Test	Tolerance± (feet)
Case leak test	100
Hysteresis test:	
• First test point (50 % of max. altitude)	75
• Second test point (40 % of max. altitude) (amended 2007/12/30)	75
After effect test	30

Table III - Altitude Tolerance

Altitude (feet)	Tolerance± (feet)
1,000	70
2,000	70
3,000	70
5,000	70
10,000	80
15,000	90
20,000	100
25,000	120
30,000	140
35,000	160
40,000	180
50,000	250

Table IV - Pressure Altitude Difference

Pressure Altitude (inches of Hg)	Difference (feet)
28.10	-1727
28.50	-1340
29.00	-860
29.50	-392
29.92	0
30.50	531
30.90	893
30.99	974

APPENDIX C - AIRCRAFT WEIGHT AND BALANCE CONTROL

(refer to paragraph 605.92(1)(c) of the CARs)
(amended 2002/09/01)

(1) **Weight and Balance Reports**

(a) The empty weight of an aircraft stated in a weight and balance report shall include all items required by the basis of the aircraft type certification, and all additional items of installed equipment. Any item not forming part of the type design shall be entered in an equipment list with its associated weight and moment. This list constitutes a part of the weight and balance report.

(b) Weight and Balance reports shall be certified by signing a maintenance release.

(2) **Amendments to Weight and Balance**
(amended 2002/09/01)

(a) Following a modification or a major repair that involves a change to the empty weight or centre of gravity of an aircraft, the person who made the change shall make an entry into the journey log or approved alternative system as soon as practicable after the change but, at the latest, before the next flight, which shall include:
(amended 2007/12/30)

(i) a description of the change;
(amended 2002/09/01)

(ii) the effective date of the change; and

(iii) the weight and moment arm of each item installed or removed.
(amended 2002/09/01)

(b) Subject to the requirements of section (1), the particulars in respect of changes to the empty weight or centre of gravity shall be transcribed in the empty weight and balance report, or, if an approved fleet empty weight and balance control program is in effect, in the empty weight and balance data for the aircraft, in accordance with the requirements applicable to the transfer of data from the journey log, set out in section 605.96 of the CARs.
(amended 2002/09/01)

Information Notes:
(amended 2002/09/01)

(i) Paragraph (2)(a) above allows for the temporary removal of aircraft equipment for repair, or incorporation of a modification or repair, without the need to immediately amend the empty weight and balance report.

(ii) When the pertinent changes are transcribed from the journey log, pursuant to paragraph (2)(b), the amended empty weight and balance report will indicate the actual empty weight, as stated in section (1) of this appendix.

(iii) Pursuant to section 605.85 of the CARs, a maintenance release is to be signed in respect of the maintenance performed, when applicable.

(c) Following any change to installed equipment, the weight and balance report equipment list shall be amended to reflect the change.
(amended 2007/12/30)

(3) **Aircraft Having Alternative Configurations**

(a) Where an aircraft is likely to be operated in two or more different configurations, a separate weight and balance report addendum for each configuration may be used to meet the requirements of section (2), provided that each addendum:
(amended 2002/09/01)

(i) contains a supplementary list which clearly shows the differences from the basic aircraft configuration;

(ii) includes the empty weight and centre of gravity for the applicable configuration; and

(iii) is clearly identified with respect to the aircraft configuration to which it applies.

(b) For each change of configuration to which a change of aircraft weight and balance addendum applies, the currently applicable addendum shall be identified in the aircraft journey log.

APPENDIX D – FIELD REPAIR OF AIRCRAFT PROPELLERS
(amended 2007/12/30)

1. Blade Repairs
(amended 2007/12/30)

All repairs shall be made in accordance with the manufacturer's recommendations. This section provides guidance on the field repair of propeller blades where manufacturer's repair manuals do not specify the level of work which can be performed in the field.

In cases of conflict, the current manufacturer's recommended repair practices shall take precedence. As a general guide, permissible field repairs are restricted to the following:

(a) Wooden Propellers

Small cracks that are parallel to the grain can be filled with glue, and sanded flush with the propeller surface. Dents or scars can be filled with a mixture of glue and fine sawdust provided that they are surface defects only (i.e. no more than 5 per cent of blade thickness). (amended 2007/12/30)

Narrow slivers of up to 1/8 inch wide broken from the trailing edge can be repaired by sandpapering a new edge, removing the least amount of material necessary to achieve a smooth contour. Both blades shall be altered by the same amount.

Following repair the propeller shall be re-protected with an even coat of varnish. These repairs add nothing to the strength of the propeller. They are intended to preserve the aerodynamic shape and prevent the ingress of moisture. Any repairs other than those described are beyond the scope of the AME in the field.

(b) Aluminum-alloy Propellers

Information Note: *The most common error in blade repairs is failure to remove sufficient material. This can lead to the damage being blended out over too small an area, causing unacceptably high local stress concentrations. In the worst cases the original fatigue crack may still be present after blending, being concealed by the smearing action of the blending file.*
(amended 2007/12/30)

Correct repair procedure involves not only the removal of all damage, but also the elimination of local stress concentrations. When this has been achieved, the finished repair is assessed against the blade repair limits to determine if the blade may remain in service. Field repair limits for aluminum-alloy blades are illustrated in figure 1 of this appendix.

Aluminum-alloy propeller blades with dents, scratches, nicks, leading-edge pitting, etc., can be repaired as described below unless contrary to manufacturer's recommendations. Multiple repairs can be made provided their location with respect to each other is not such

as to form a continuous line across the blade. Sharp riffler or fine-cut files can be used for removing material. The use of blunt or worn files to blend out nicks will smear metal into cracks, rendering them difficult to detect. Finally, the area should be smoothed with fine crocus cloth.
(amended 2007/12/30)

Blend out nicks, scars, cuts, lightning burns, etc. on the leading edge of aluminum-alloy blades as shown in figure 2 of this appendix. The finished repair must be blended over a distance at least 10 times the depth of damage. In addition to blending the planform, care should be taken to restore the original cross-sectional profile.
(amended 2007/12/30)

Blades with the leading edges pitted from normal wear in service can be reworked by removing sufficient material to eliminate the pitting. In this case, remove the metal by starting well back from the edge, as shown in figure 3 of this appendix, and working forward over the edge in such a way that the contour will remain substantially the same, avoiding abrupt changes in contour or blunt edges. Trailing edges of blades can be treated in a similar manner.

On the thrust and camber faces of blades, remove the metal around any dents, scratches, cracks and burns to form shallow saucer-shaped depressions as shown in figure 4 of this appendix. Take care to remove the deepest point of the damage. If, prior to commencement of the work, two lines are drawn on the blade with a soft crayon or marker, in such a way that they intersect at the deepest point, this will assist in locating the point as the work progresses. (Do not use a lead pencil for this purpose, as it can cause corrosion due to electrolytic action).

As indicated in the example, the finished repair should have its longest axis in a spanwise direction (root to tip) irrespective of the alignment of the original damage. The reworked area must extend over a distance of at least 10 times the depth in a chordwise direction, and 30 times the depth in a spanwise direction.
(amended 2007/12/30)

When the treatment of defects on a blade tip necessitates shortening of the blade, each blade on the propeller shall be shortened by the same amount. The use of a template will assist in keeping the planform of each blade identical. Remove sufficient material from the cambered face of the blade to maintain the original shape of the blade cross-section. Take care not to reduce the blade diameter below the minimum permitted for the particular installation. On certain installations, no reduction is permitted; however, the maximum reduction in blade length is normally 2%. Details of any change in blade diameter must be entered in the leading particulars section in the front of the propeller log.

On completion of the blending out of any damage, inspect the area with a x5 or x10 magnifying glass. If certain that no cracks remain, remove a further .002" by polishing with fine crocus paper as an additional stress relieving measure. In the case of lightning burns,

remove .020" to ensure that no heat damaged material remains. (Some manufacturers can also specify a local hardness check following lightning strike).

The finished repair can then be checked by depth gauge or callipers to ensure that the final dimensions are within limits. The maximum field repair limits are specified in figure 1 of this appendix, which applies provided that the minimum approved blade dimensions are observed.

As indicated in figure 1 of this appendix, more material can be removed near the tip than near the root, as the forces acting on the blade are lower in this area. It should not be assumed, however, that repairs near the tip are not critical. In fact, the majority of failures take place in the outer portion of the blade. Great care must be taken to remove stress raisers at any point on the blade.
(amended 2007/12/30)

Finally, the entire area shall be subjected to a close examination for cracks prior to the application of protective coating. The use of an etch and penetrant dye process, to detect residual cracks following blending out of damage, is strongly recommended. No straightening of bent blades, welding, or heat treatment, is permitted in the field. If it should be necessary to straighten a propeller to facilitate its packing for return to an approved overhaul organisation, an accurate drawing of the bend prior to straightening shall accompany the propeller. No peening is permitted, except where specifically recommended by the manufacturer. The flattening of rough areas by rolling or peening is prohibited under all circumstances.

(c) **Steel And Composite Propeller Blades**

Information Note:

No general comments can be made about the repair of steel or composite blades, as repair schemes vary widely.

All repairs are to be carried out in accordance with the propeller manufacturer's recommendations or methods.
(amended 2007/12/30)

2. Field Repair Standards Aluminum Blades
(amended 2007/12/30)

The field repair limits shown below can be applied, provided the tolerances of the appropriate blade specification are not exceeded. Repairs which exceed these limits may only be performed by an approved propeller overhaul organization.
(amended 2007/12/30)

Figure 1 - Field Repair Limits

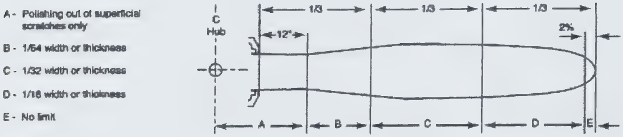


Figure 2 - Local Rework Face or Edge

	"A"
Face and camber sides	30
Leading and trailing edges	10

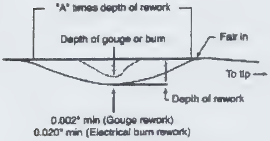


Figure 3 - Rework-Leading Edge

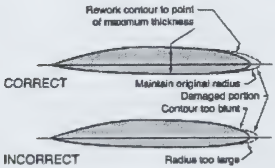
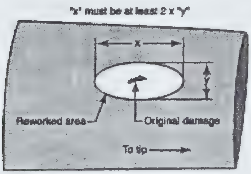


Figure 4 - Rework Blade Face



APPENDIX E - INSPECTION OF AIRCRAFT WOODEN COMPONENTS

(1) **Preamble**

Experience has shown that in addition to the normal routine maintenance inspections, all aircraft which have wooden components in their primary structure require very thorough repetitive inspections, especially of the glued joints, to determine continuing structural soundness.

While excessive moisture has been the cause of both glued joint failures and delamination of plywood, another factor to be considered is the deterioration of the structure with time. Tests have shown that even in well maintained and properly stored components, the loss of linear strength of a glued joint can amount to 60% in ten years' time.

Fungi may, under conditions that favour their growth, attack the wood resulting in a condition designated as decay. Decay can occur at temperatures that favour growth of plant life in general. Serious decay occurs only when the moisture content of the wood is above the fibre saturation point (average 30 percent). These conditions are particularly prevalent in the South-eastern United States but may also be encountered in Canada. Only when previously dried wood is contacted by water, such as provided by rain, condensation, or contact with wet ground, will the fibre saturation point be reached. The water vapour in humid air alone will not wet wood sufficiently to support significant decay, but it will permit development of some mould. If excessive moisture is not allowed to enter the wood fibres, there is virtually no limit to the components' structural life expectancy.

(2) **Methods**

Unless otherwise specified by the manufacturer of the aeronautical product, the following standards of airworthiness apply to the inspection of wooden components:

(2.1) **Exterior Surface Inspection**

(a) Inspect the entire exterior surface of the component (wing, fuselage, tail, etc.) for the following characteristics:

(i) Signs which indicate that the wood immediately below the fabric is soft or contains excessive moisture (i.e swollen). Soft wood may be located and/or confirmed by depressing the components surface in the vicinity of the area in question with a rounded, blunt instrument and comparing its hardness with that of good wood. Note that the areas being compared must have identical substructure.

(ii) Signs which indicate that the fabric/paint is delaminating from the wood surface (bubbles, discoloration, boils, soft spots and other surface flaws).

(iii) Cracks or breaks in the paint. Water is prevented from entering the component by the fabric/paint barrier. Any cracks in this barrier, no matter how small, may comprise its ability to prevent water from entering the wood.

(iv) Exterior damage which would allow water to penetrate the fabric/paint barrier and enter the wood.

The surface features described in (i), (ii), and (iv) can be accentuated by illuminating the surface with a light source placed at a shallow angle.

The following technique can be used by an experienced person to detect soft and/or decayed wood in the wing spars. Tap the wing directly above and below both spars with a small rounded, blunt instrument, approximately the size of a small pocket knife. Start at the outboard end and work inboard, listening to the sound generated by the wing. The sound quality will change slowly. If the change in sound is abrupt, the wood directly below the surface may have decay.

The above method can also be adapted to check other components for decay.

(b) Mark the areas which have the characteristics described in paragraph 2.1(a) of this appendix, and refer to subsection 2.3 of this appendix for additional inspection procedures.

(2.2) **Internal Inspection**

(a) Remove all inspection/access covers.

(b) Using a flashlight and a mirror, inspect the entire interior of the component for the following problems:

(i) wood decay;

(ii) water stains on wood or covering;

(iii) pooled dust/dirt which may indicate evidence of previous standing water;

(iv) rust or corrosion on metallic surfaces;

(v) detectable moisture.

(c) Make note of any areas which have the characteristics described in paragraph 2.2(b) of this appendix, and refer to subsection 2.3 of this appendix for additional inspection procedures.

(d) Be certain that all drain holes are completely open and free of burrs and/or pieces of fabric which would cause water to be retained.

(2.3) **Moisture Test and Probing Inspection**

(a) If the inspection described in subsections 2.1 and 2.2 identify any questionable areas, continue the progressive inspection by testing these areas per the following procedures:

(i) Test for soft/decayed wood with sharp probe.

(ii) Test for moisture content using suitable resistance type moisture meter (model G-2, Delmhorst Instrument Company, Boonton, New Jersey, or equivalent).

The probing inspection is designed to identify wood by penetrating it with a sharp object such as an awl or sharp pocket knife. You can "calibrate" the probe instrument yourself by testing known good wood of a quality equal to that used in the component. Note that the airframe is constructed with several different kinds of woods, each of which have a noticeably different hardness.

(b) If, during the inspection of a component, you suspect that the structure has decay close to the surface, you can remove a small plug of the wing skin (1/16 inch thick or 1/8 inch thick) to probe inspect the structure material directly. Sharpen a 1/4 inch drill bit so that its point angle is very flat and provide it with a stop which prevents it from penetrating to a depth greater than the thickness of the skin; test the drill bit on a separate piece of plywood to ensure that it cuts clean and penetrates the proper amount. If the probing inspection indicates good wood, the plug must be replaced using standard repair procedures.

(c) If the inspection described in subparagraph 2.1(a)(iii) gives you reason to suspect that there may be decay in a fuel tank area, a more thorough inspection can be conducted by removing fuel tank covers.

(d) If moisture content is below 15% and the wood is solid as determined by probing, the structure is considered airworthy. If moisture content is 15% or above and the wood is solid as determined by probing, the structure is still considered airworthy but repetitive inspections of suspected areas are required every 15 days until moisture content is below 15%. Moisture content will decrease provided no additional water is allowed to enter wood fibres. The drying process can be assisted by directing warm, dry air over the entire suspected area, taking moisture readings daily; do not allow the moisture content to go below 10%. All deficiencies which would allow water to come in contact with wood fibres shall be corrected prior to exposing the aircraft to high moisture conditions.

(e) If probing indicates soft or decayed wood, the affected structural members shall be replaced. The repairs can be accomplished with reference to the following documents:

(i) FAA AC 43.13-1: Department of Transportation, Federal Aviation Agency, 1972, *Acceptable Methods, Techniques and Practices - Aircraft Inspection and Repair*; available from:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C.,
U.S.A. 20402

(ii) ANC-18: Munitions Board Aircraft Committee, June 1951, *Design of Wood Aircraft Structures*, Chapter 4 - Detail Structural Design; available from:

USA Naval Depot
5801 Tabor Avenue
Philadelphia, PA.,
U.S.A. 19120

(iii) Designer or Kit Manufacturer drawings and repair schemes.

APPENDIX F - ATC TRANSPONDER PERFORMANCE TESTS

The performance of Air Traffic Control (ATC) transponders can be tested using either a bench check or portable test equipment and shall meet the standards of airworthiness requirements elaborated in relation to section 571.02 of the CARs and listed in paragraphs (a) through (k) of this appendix. The test required by paragraph (k) is a system integration test to verify the accuracy of the data transmitted by the system as a whole, and as such shall be conducted on the aircraft. In order to prevent interference with the Air Traffic Control Radar Beacon System (ATCRBS) and airborne aircraft equipped with TCAS, portable test equipment shall be used with the appropriate precautions and operated at a rate of 235 interrogations per second. An additional 3 decibel (dB) loss is allowed to compensate for antenna coupling errors during receiver sensitivity measurements conducted in accordance with subsection (c)(1) when using portable equipment.
(amended 2007/12/30)

Information Notes:
(amended 2007/12/30)

(i) Interference prevention can be accomplished by antenna shielding, direct coupling of aircraft transponder antenna to test set, or the use of anechoic enclosures away from other aircraft or reflective obstructions.
(amended 2007/12/30)

(ii) For definition of classes of transponders refer to the US FAA's Technical Standard Order (TSO-C112) entitled "Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment".
(amended 2007/12/30)

(a) **Radio Reply Frequency**

(1) For all classes of ATCRBS transponders, interrogate the transponder and verify that the reply frequency is 1090 ±3 Megahertz (MHz).

(2) For 1B, 2B and 3B Mode S transponders, interrogate the transponder and verify that the reply frequency is 1090 ±3 MHz.

(3) For class 1B, 2B and 3B Mode S transponders that incorporate the optional 1090 ±1 MHz reply frequency, interrogate the transponder and verify that the reply frequency is correct.

(4) For class 1A, 2A, 3A, and 4 Mode S transponders, interrogate the transponder and verify that the reply frequency is 1090 ±1 Mhz.

(b) **Suppression**

(1) When class 1B and 2B ATCRBS transponders, or class 1B, 2B and 3B Mode S transponders are interrogated on Mode 3/A at an interrogation rate between 230 and

1,000 interrogations per second; or when class 1A and 2A ATCRBS transponders or class 1B, 2A, 3A and 4 Mode S transponders are interrogated at a rate between 230 and 1,200 Mode 3/A interrogations per second:

(i) Verify that the transponder does not respond to more than 1 percent of the interrogations when the amplitude of P2 pulse is equal to P1 pulse; and,

(ii) Verify that the transponder replies to at least 90 percent of the ATCRBS interrogations when the amplitude of the P2 pulse is 9 dB less than the P1 pulse. If the test is conducted with a radiated test signal, the interrogation rate shall be 235 ±5 interrogations per second unless a higher rate has been approved for the test equipment used at that location.

(c) **Receiver Sensitivity**

(1) Verify that for any class of ATCRBS transponder, the receiver minimum triggering level (MTL) of the system is - 73 ±4 dbm, or that for any class of Mode S transponder, the receiver MTL for Mode S format (P6 type) interrogations is -74 ±3 dbm by use of a test set that is:
(amended 2007/12/30)

(i) connected to the antenna end of the transmission line;

(ii) connected to the antenna terminal of the transponder with a correction for transmission line loss; or

(iii) utilising a radiated signal.

(2) Verify that the difference in Mode 3/A and Mode C receiver sensitivity does not exceed 1 dbm for either any class of ATCRBS transponder or any class of Mode S transponder.

(d) **Radio Frequency (RF) Peak Output Power**

Information Note: The maximum transmitter power output measured at the terminal of the antenna corresponds to the standard specified in TSO-C74c and RTCA/DO-181C Document related to the Minimum Operational Performance Standards for air traffic control radar beacon system.
(amended 2007/12/30)

(1) Verify that the transponder RF output power is within specifications for the class of transponder. Apply the same conditions as described in paragraph (c)(1) above.
(amended 2007/12/30)

(i) For class 1A and 2A ATCRBS transponders, verify that the minimum RF peak output power is at least 21.0 dbw (125 watts).

(ii) For class 1B and 2B ATCRBS transponders, verify that the minimum RF peak output power is at least 18.5 dbw (70 watts).

(iii) For class 1A, 2A, 3A, 4 and class 1B, 2B and 3B Mode S transponders that include the optional high RF peak output power, verify that the minimum RF peak output power is at least 21.0 dbw (125 watts).

(iv) For class 1B, 2B and 3B Mode S transponders, verify that the minimum RF peak output power is at least 18.5 dbw (70 watts).

(v) For any class of ATCRBS or any class of Mode S transponders, verify that the maximum RF peak output power does not exceed 27.0 dbw (500 watts).

(e) **Mode S Diversity Transmission Channel Isolation**

Information Note: The tests specified in paragraphs (e) through (j) apply exclusively to Mode S transponders.
(amended 2007/12/30)

For any class of Mode S transponder that incorporates diversity operation, verify that the RF peak output power transmitted from the selected antenna exceeds the power transmitted from the nonselected antenna by at least 20 dB.

(f) **Mode S Address**

Interrogate the Mode S transponder and verify that it replies only to its assigned address. Use the correct address and at least two incorrect addresses. The interrogations shall be made at a nominal rate of 50 interrogations per second.

(g) **Mode S Formats**

Interrogate the Mode S transponder with uplink formats (UF) for which it is equipped and verify that the replies are made in the correct format. Use the surveillance formats UF=4 and 5. Verify that the altitude reported in the replies to UF=4 are the same as that reported in a valid ATCRBS Mode C reply. Verify that the identity reported in the replies to UF=5 are the same as that reported in a valid ATCRBS Mode 3/A reply. If the transponder is so equipped, use the communications formats UF=20, 21 and 24.

(h) **Mode S All-call Interrogations**

Interrogate the Mode S transponder with the Mode S-only all-call format UF=11 and the ATCRBS/Mode S all-call formats (1.6 microsecond P4 pulse) and verify that the correct address and capability are reported in the replies (downlink format DF=11).

(i) **ATCRBS-only All-call Interrogation**

Interrogate the Mode S transponder with the ATCRBS-only all-call interrogation (0.8 microsecond P4 pulse) and verify that no reply is generated.

(j) **Squitter**

Verify that the Mode S transponder generates a correct squitter approximately once per second.

(k) **Integration Test**

(1) The integration of the automatic pressure altitude reporting and ATC transponder systems shall be inspected and tested in accordance with the following procedures:
(amended 2007/12/30)

(i) The altimeter shall be adjusted to a setting of 1013.2 millibars (29.92 inches of mercury) for altitudes from sea level to the maximum certified altitude of the aircraft,

(ii) Measure the automatic pressure altitude at the output of the installed ATC transponder when interrogated on mode C at sufficient altitude levels up to the certified altitude of the aircraft. The following altitude levels will exercise all pulse positions up to 50,000 feet:

(A) 500',

(B) 1,300',

(C) 2,700',

(D) 10,000',

(E) 14,800',
(amended 2000/12/01)

(F) 30,800'. The difference between the automatic reporting output and the altitude displayed on the aircraft altimeter shall not exceed 125 feet.

(2) Whenever an error is reported in the altitude reporting data, or when maintenance is performed on the system that could introduce a correlation error, the integration test shall be performed.
(amended 2007/12/30)

(3) Subject to subsection (2), when the maintenance performed consists of the installation of a line replaceable unit (LRU) and the installed LRU is a known airworthy part, the integration test need not be accomplished if an operational test is carried out prior to flight.
(amended 2007/12/30)

APPENDIX G - MAINTENANCE OF EMERGENCY LOCATOR TRANSMITTERS (ELTs)

(a) **Corrosion Inspection**

ELTs installed in aircraft are subject to extreme environmental conditions which may cause corrosion to develop in circuit boards and battery compartments. As a minimum, corrosion inspection shall be performed during each required battery replacement and performance test.

(b) **Operational Testing**

Information Notes:

(i) ELT operational tests only provide the aircraft operator with an indication that the ELT is transmitting; however, a positive result cannot be interpreted as meaning that the ELT meets all operational parameters.

(ii) The periodicity of operational checks is at the operator's discretion, but the check shall only be conducted during the first five minutes of any UTC , (co-ordinated universal time) hour, and restricted in duration to not more than five seconds.

An acceptable procedure for operational tests is to:

(1) Tune the aircraft or other VHF receiver in the area to 121.5 MHz;

(2) Activate the ELT for not more than five seconds, while monitoring the VHF receiver; approximately three ELT audio sweeps are to be heard;

(3) Reset the ELT to ARM or AUTO, as applicable, and continue to listen to 121.5 MHz for a few seconds to ensure that the ELT does not continue to transmit after the test is terminated.

(c) **Performance Testing**

(1) Testing of any ELT shall be conducted in a screen room or metal enclosure, or, the transmitter power output shall be connected to a suitable dummy load to minimize radiation.

(2) For ELTs powered by other than water activated batteries, the performance test shall be performed using the ELT's own battery. An alternate power source can be used where lengthy servicing, other than the performance test, is anticipated.

(3) As a minimum, the performance test for ELTs powered by non water-activated batteries shall include:

(a) the measured peak power after 3 minutes of operation;

(b) the measured frequency after 3 minutes of operation;

(c) the audio modulation, which shall be recognisable as a typical ELT signal, and shall meet the specifications of the ELT manufacturer;

(d) the measured current draw in the "Arm" or "Auto" position, and in the "On" position as specified by the ELT manufacturer; and

(e) a test of the automatic activation system.

(4) Except for the automatic activation system test, the performance test for ELTs utilising water activated batteries shall include all of the above (see paragraph 3).

(5) Following satisfactory completion of a performance test, the date on which the test was performed shall be marked on the external casing in a legible and permanent manner.

(d) **Battery Replacement and Recharging**

(1) Battery manufacturers are required to indicate the type, model, part number, ELT type & model(s) for which the battery has been approved, and the battery's expiry date.

(2) The following general guidelines relate to the replacement of ELT batteries:

(a) only batteries approved for the particular ELT type are to be installed;

(b) following each battery replacement, recharge or capacity test, the date when the next replacement, recharge or capacity test becomes due shall be marked in a legible and permanent manner on the external casing of the ELT and, where the ELT is installed on a life raft, on the outside of the life raft;

(c) an operational test shall be performed following reinstallation in an aircraft of an ELT which has been removed for any reason.

(3) Non-rechargeable batteries shall be replaced by serviceable batteries:

(a) After use of the ELT in an emergency;

(b) After an inadvertent activation of unknown duration;

(c) When the cumulative time of all known transmissions exceeds one hour; and,

(d) On or before the proposed battery replacement date.

(4) Rechargeable batteries shall be recharged:

(a) immediately before the ELT is installed in an aircraft;

(b) after use in an emergency;

(c) after an inadvertent activation of unknown duration;

(d) at the time intervals established by the ELT manufacturer; and

(e) when the cumulative time of all known transmissions exceeds one hour.

(5) Capacity tests and recharging shall be accomplished at the time intervals, and in accordance with the procedures established by the manufacturer.

(6) Water-activated batteries shall be replaced by serviceable batteries after activation or under any other conditions specified by the ELT manufacturer.

(e) **Shipping**

When shipping an ELT, the battery shall be disconnected. If that is not practicable, the ON/OFF/ARM switch shall be secured in the "OFF" position.

APPENDIX H – PROCESS TO EVALUATE UNDOCUMENTED AIRCRAFT PARTS

(refer to paragraph 571.10(4)(u), Types of work Table)
(amended 2002/03/01)

The following numbers correspond to the sequence of steps illustrated in the flow chart:

1. **Parts at receiving:** Retain all historical documents, tags, invoices, and packing slips for evaluation.

2. **Part Identification:** Verify that the part has certification or sufficient documentation, or both as applicable, to ascertain that it is a genuine part (i.e. nomenclature, part number, serial number, time in service) and that the part corresponds to that documentation. If the part appears to be a used part, verify that the identity of the aircraft from which the part was removed is documented. Verify that the technical records indicate that the applicable Airworthiness Directives and equivalent applicable directives issued by a foreign civil aviation authority have been accomplished.

3. **Stores:** Complete incoming stock procedures and place in stores by following the procedures described in the company Maintenance Policy Manual (MPM).

4. **Exceptions:** Section 571.09 of the CARs limits the installation of used life limited parts to those for which a complete technical history is available. Therefore, parts of the following kinds that are considered undocumented at step 2, are not be further evaluated under this appendix:

(a) life-limited parts that are subject to limits on flying hours, landings, operating cycles or calendar time in service, or combinations thereof;

(b) parts that are required to be rejected in accordance with the instructions for continued airworthiness following an abnormal occurrence; or

(c) parts that are eligible for use in multiple applications with different operational limitations, or different limits on the time in service, which if exceeded would require rejection of the part.

5. **Part considered authentic:** Consider the following factors when evaluating the authenticity of the part:

(a) the origin of the part (i.e. was the part received from a reliable source?);

(b) documentation such as packing slip, manufacturer's identification tag, identity of component from which the part was removed; and

(c) part nomenclature, part number, serial number, manufacturer's identification marks or stamps found on the part.

6. **Documentation:** Record and retain evidence of all tasks accomplished throughout the process of ascertaining the authenticity of the part. Detail each step of the process up to and including certification.

7. **Evaluation:** Using all available information, conduct an inspection of the part in accordance with the instructions for continued airworthiness or available type design data, or with both as applicable, for the part. It may be necessary to evaluate the part by comparison with a known authentic part. The evaluation process may require the use of hardness tests to determine heat treatment of the material. Procedures may be required to determine various material processes that may have been conducted on the material such as shot peening. Test all primary structural parts to determine that they are of the same material and in the same material condition as the type design product, either by comparison with the type design data (e.g. drawings) or by conducting comparison tests with a known authentic part.

8. **Fit form and function:** Check each part for physical interface with integral parts (e.g. shape, size, dimensions, mass and other parameters uniquely characterizing the part) and check the actions that the part is to perform. Ensure that all dimensions are within published wear limits. Where wear limits are not published, ensure that the dimensions do not exceed known limits for new parts.

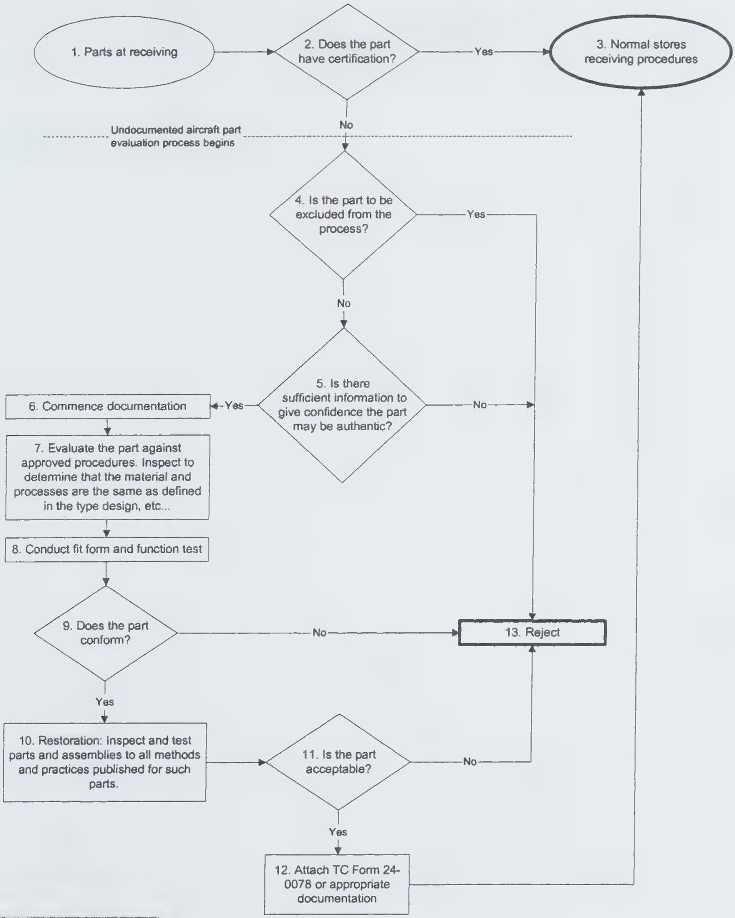
9. **Conformity:** Verify that the part conforms to all applicable characteristics.

10. **Restoration:** Inspect and test parts and assemblies to all methods and practices published for such parts.

11. **Acceptability:** The part is acceptable for certification when it meets all the requirements of the type design or instructions for continued airworthiness and approved procedures including inspection, overhaul and testing. Ensure that all Airworthiness Directives and equivalent directives issued by a foreign civil aviation authority applicable to the part are complied with.

12. **Certification and supporting documents:** If the part has been found acceptable under para. 11, fill out and sign a maintenance release, meeting the requirements of section 571.10 of the CARs, and provide any other supporting documentation that may be required such as calibration records and test results, and ensure the certification documents accompany the part.

13. **Reject:** Ensure that any part that has reached its life limit is rendered unusable, or that it is identified as unairworthy and kept segregated from airworthy parts, in accordance with section 571.09 of the CARs.



(amended 2007/12/30)

APPENDIX I – RESERVED
(amended 2007/12/30)

APPENDIX J
AUTHORIZED RELEASE CERTIFICATE
(amended 2008/12/30)

(refer to section 571.10 of this standard)

The Authorized Release Certificate described in this Appendix conforms to a standardized, internationally recognized format for the release of both new and used (maintained) aeronautical products (herein also referred to as items or parts). When used to certify the maintenance of used parts, it forms a means for issuance of the maintenance release required by CAR 571. When used to certify new parts, it provides a means for issuance of the statement of conformity required by CAR 561.

These instructions relate only to the use of the Authorized Release Certificate as a maintenance release for parts maintained by Canadian Approved Maintenance Organizations (AMOs). For the requirements applicable to the release of parts maintained under the jurisdiction of other national authorities, refer to the applicable foreign regulations.

For the certification of new parts, refer to CAR 561 and the associated standards.

The Authorized Release Certificate (hereinafter referred to as "certificate") is not an official Transport Canada form, but rather a template that may be used by industry organizations for the development of their own certificates. Subject to the conditions outlined in this Appendix, organizations may design their own certificates from scratch, or copy the blank examples and modify them as necessary. Blank samples may also be downloaded from the Transport Canada web site, where they are available in both *.xls and *.pdf formats.

Purpose and Use

The primary purpose of the certificate is to certify that an aeronautical product has been maintained in accordance with the applicable airworthiness requirements.

The certificate may be used for items intended for installation on foreign aircraft, as well as for domestic purposes. It is considered to be valid worldwide but acceptance of the items certified on it will be dependent upon the regulations of the national civil aviation authority concerned and on compliance with the terms of any applicable bilateral agreement or technical arrangement between that authority and Transport Canada. When using the certificate to satisfy such special conditions, compliance must be certified according to the requirements of the applicable agreement or arrangement. The certificate is not a delivery or shipping note.

While the Canadian version of the certificate is not an official Transport Canada form, it has been allocated the title FORM ONE for harmonized international identification purposes. This title replaces the previous designation 24-0078.

Maintenance releases using the certificate may only be issued by AMOs approved by Transport Canada, and only for work performed directly under their control and within the scope of their approval. Aircraft are not to be released using the certificate.

The certificate does not constitute approval to install the maintained item(s) on a particular aircraft, engine, or propeller but helps the end user determine the item's airworthiness approval status.

A mixture of new and used items is not permitted on the same certificate.

General Format

The certificate must comply with the format shown in the following examples, including block numbers and the location of each block. The size of the blocks may vary to suit the individual application, but not to an extent that would make the certificate unrecognizable. The certificate must be in "landscape" format, but the overall size may be significantly increased or decreased so long as the certificate remains recognizable and legible. If in doubt, consult with Transport Canada.

All printing must be clear and legible to permit easy reading.

The certificate may either be pre-printed or computer generated, but in either case the printing of lines and characters must be clear and legible. Pre-printed wording is permitted in accordance with the examples, but no other certification statements are permitted. The preprinted statements on the certificate must appear in either English or French. Bilingual or multilingual formats may be used, provided one of the languages is either English or French.

The details to be entered on the certificate may be either machine/computer printed or hand-written using block letters and must permit easy reading. Abbreviations should be restricted to a minimum.

The user/installer responsibility statements may be placed on the bottom margin or on the reverse side of the certificate. The space remaining on the reverse side of the certificate may be used by the originator for any additional information but must not include any certification statement.

Copies

The certificate must accompany the items described and correlation must be established between the certificate and the item(s). A copy of the certificate must be retained by the organization that raised it. Where both the certificate format and the data are entirely computer generated, retention by means of secure database is acceptable provided it is possible to generate a hard copy on request.

There is no restriction on the number of copies of the certificate sent to the customer.

The certificate may be attached to the certified item directly, or may be placed in an envelope for protection and the envelope attached to the item.

Lost Certificate:

A request for the replacement of a certificate declared lost must come from the owner of the item. A file copy of the original certificate should be provided to the owner. The replacement certificate serves as a historical record and not as a statement of the item's current condition.

Errors On A Certificate:

If an end user finds one or more errors on a certificate, they must identify them in writing to the originating AMO. Originators may issue a corrected certificate provided they can verify and correct the errors. The corrected certificate must have a new tracking number, signature and date.

The corrected certificate must contain an original signature in block 14b and the current date the signature is appended in block 14e.

A request for a corrected certificate may be honoured without verification of the item's condition, but a corrected certificate is not a statement of current condition and should include an explanation in block 12, including a reference to the previous certificate. Both certificates should be retained according to the retention period applicable to the first certificate.

The corrected certificate serves as a historical record and not as a statement of the item's current condition.

Completed Certificate

Refer to Figure 2 for an example of an appropriately completed certificate. When filling in the certificate, all entries must be in either English or French, and either typed or clearly printed in block letters in permanent ink. All blocks must be completed. Inapplicable items must be either marked "N/A" or struck out.

Once completed, the Authorized Release Certificate becomes part of the technical record for the item to which it relates, and eventually will become part of the technical record of the next higher assembly on which that item is installed. The certificate is therefore subject to all the applicable regulations related to maintenance and technical records.

Completion of Certificate by the Originator

Block 1 – Approving Civil Aviation Authority (CAA) /Country

Block 1 is reserved for the name and country of the Civil Aviation Authority under whose jurisdiction this certificate is issued. The entry "Transport Canada" satisfies both requirements and is the only entry that may be made in respect of items maintained under Canadian regulations. This text may be pre-printed on blank certificates.

Block 2 Title block – The title "AUTHORIZED RELEASE CERTIFICATE —FORM ONE" should be pre-printed on the blank certificate, so no further entry is required in this block.

Block 3 – Form Tracking Number

Enter the unique number established by the numbering system/procedure of the AMO identified in block 4; this may include alpha/numeric characters. The originating organization must establish a tracking system to correlate the certificates with information on the released parts.

Block 4 – Organization Name and Address

Enter the full name and address of the AMO releasing the item (s) covered by the certificate. Logos, etc., of the organization are permitted if they can be contained within the block. This information may be pre-printed on the blank certificates.

Block 5 – Work Order/Contract/Invoice

To facilitate traceability of the items, where applicable enter the customer's work order number, contract number, invoice number, or similar reference; if none of these are applicable, enter "N/A".

Block 6 – Item

The block is provided to permit easy cross-reference to other blocks, preventing ambiguity by the use of line item numbers. Block 6 must be completed where there is more than one line item and reference to the items is made in other blocks. Where necessary, it is permissible to add lightly ruled lines to aid in separating the information relating to each line number.

Block 7 – Description

Enter the name or description of the item. In the case of multiple items, enter the description for each item number listed in block 6. Preference should be given to the term used in the Instructions for Continued Airworthiness (Illustrated Parts Catalogue, Aircraft Maintenance Manual, Service Bulletin, etc).

Block 8 – Part Number

Enter the part number as it appears on the item (or tag/packaging). In the case of an engine or a propeller, the type designation may be used. In the case of multiple items, enter the description for each item number listed in block 6.

Block 9 – Quantity

State the quantity of each item. In the case of multiple items, enter the quantity of each item number listed in block 6.

Block 10 – Serial/Batch Number

If the item is required by the applicable design data to be identified with a serial number or equivalent identification, enter it in block 10. If no serial number or equivalent

identification is applicable, a batch number or other equivalent unique identifying number may be entered. If no unique identifying number is available, enter "N/A".

Block 11 – Status/Work

The following table describes the permissible entries for block 11. Do not use any other terms. Enter only one of the terms listed. Where more than one of the terms is applicable, use the one that most accurately describes the majority of the work performed. For example, where an overhaul was carried out, and modifications and / or repairs were conducted as part of the overhaul, simply enter "Overhauled." Where necessary, more detailed explanations of the work done shall be entered in block 12 and on referenced supporting documents.

Entry	Meaning
Overhauled	The item has undergone a restoration process that ensures it is in complete conformity with the applicable service tolerances specified in the Type Certificate holder's Instructions for Continued Airworthiness, or equivalent data acceptable to the Minister. As a minimum, it must have been disassembled, cleaned, inspected, repaired as necessary, reassembled (using replacement parts where required) adjusted as required and tested, and found to conform to the above specified data.
Repaired	Deficiencies in the item have been rectified as described in block 12, and in relation to those deficiencies*, the item has been restored to an airworthy condition.
Inspected / Tested	The item has been examined, tested, measured, etc., in accordance with an applicable standard.** Includes visual inspections, functional and operational tests, calibration and bench checks.
Modified	Alteration of an item to conform to an applicable standard.**

** Note: A maintenance release for a repair only attests to the condition of the item with relation to the repair itself, not to the condition of the item as a whole. If any other deficiencies are known to exist or other maintenance tasks are outstanding, details must be entered in block 12.*

*** Note: In this context, applicable standard means a particular design or maintenance standard, method, technique or practice that is approved by or acceptable to the authority having jurisdiction over the item concerned.*

Block 12 – Remarks

Enter in this block, either directly or by reference to supporting documentation, any information necessary for the user or installer to determine the airworthiness of an item. If necessary, a separate sheet may be used and referenced in this block.

In particular, enter details of any outstanding work required on or before installation of the item. If the item has been made or configured solely in accordance with specifications approved by a foreign airworthiness authority, and for some reason does not comply with Canadian requirements, include a statement to that effect.

Include any other information necessary to enable the installer to determine the condition and conformity of the item. Each statement must be clearly identified as to which item in block 6 it relates. If there is no statement, state "None".

Some examples of statements to be entered in block 12 are:

1. Reference to the maintenance data used, including revision status where applicable.
2. Reference to Airworthiness Directive or Service Bulletin compliance.
3. A description of any repairs carried out.
4. Details of modifications incorporated, including reference to the applicable approved data. Where applicable, this must include reference to foreign approvals. *
5. List of replacement parts installed.
6. Status of any life limited parts.
7. Details of any deviations from the customer work order.
8. Details of any outstanding tasks or known deficiencies still to be rectified.**
9. Any release statements or regulatory references needed to satisfy a foreign airworthiness authority maintenance requirement.

** Note: When working for foreign clients, cases may arise where work is performed to data approved by the foreign authority, but not approved by the Minister. This is acceptable, provided both the data and the approving authority are accurately specified in block 12. In such cases, the items would not be acceptable for installation on Canadian aircraft, but would still be eligible for the applicable foreign installation.*

*** Note: When an item undergoes sequential maintenance tasks in different organizations before it is installed in an aircraft or other higher assembly, each organization issuing an Authorized Release Certificate shall attach the previous certificates to the item along with its own. All the certificates for the various tasks must accompany the item to its final destination, and will be included in the technical record for the aircraft or other higher assembly on which the part is eventually installed.*

Blocks 13a through **13e**

These blocks are reserved for the certification of new parts by an approved manufacturer, and are not used for a maintenance release. AMOs should shade, darken, or otherwise mark this area on the pre-printed blank certificates, to preclude inadvertent or unauthorized use.

Block 14a

1. Mark the appropriate box or boxes to indicate under which regulations the completed work is being certified.

2. Work performed in accordance with the CARs (including work done for foreign clients) should always be indicated by checking the box "CAR 571.10 Maintenance Release"*

3. In addition, where work is certified in accordance with foreign requirements (such as Bilateral Agreements or Technical Arrangements that call for Maintenance Policy Manual Supplements) it must also be indicated by marking the "Other regulation specified in block 12" box. The applicable foreign regulations should be stated in block 12. Note that this reference is in addition to the identification of any approved design data that may also have to be entered in this block.

** Note: Work done to foreign approved data, even where that data is not approved by the Minister, may still be certified by means of a CAR 571.10 maintenance release, provided the work was performed in accordance with the Canadian Aviation Regulations (e.g., CAR 571 and 573) and the applicable Bilateral Agreement or Technical Arrangement.*

Block 14b - Signature

This space shall be completed with the signature of the authorized person. Only persons specifically authorized by the certificate holder in accordance with CAR 573 are permitted to sign this block. To aid recognition, a unique number identifying the authorized person may be added. Alternatives to a hand-written signature (such as a computer-generated signature facsimile) are only permitted when authorized by Transport Canada.

Signature in this block constitutes a maintenance release pursuant to CAR 571.10.

Block 14c – Approved Organization Number

Enter the approved organization number that identifies the AMO certificate issued by the Minister.

Block 14d – Name

Enter the name of the person signing Block 14b, printed, typed, or written in a legible form.

Block 14e - Date

Enter the date on which Block 14b is signed, using the format dd/mmm/yyyy (dd = 2 digit day, mmm = first 3 letters of the month, yyyy = 4 digit year) .

Bottom margin or reverse side of certificate

Place the following statement on the pre-printed blank certificates to notify end users that they are not relieved of their responsibilities concerning the installation and use of any item accompanied by the form:

Installer Responsibilities

"This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown."

Authorized Release Certificate

Figure 1 - Authorized Release Certificate

1. Approving Civil Aviation Authority/Country **Transport Canada**		2. AUTHORIZED RELEASE CERTIFICATE FORM ONE			3. Form Tracking No.
4 Organization Name and Address					5. Work Order/Contract/Invoice
6 Item	7. Description	8. Part No	9 Qty	10. Serial/Batch No	11 Status/work
12 Remarks					
13a. Certifies that the items identified above were manufactured in conformity to: ☐ approved design data and are in condition for safe operation ☐ non approved design data specified in block 12.			14a. ☐ CAR 571.10 Maintenance Release ☐ Other regulation specified in block 12 Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, has been performed in compliance with the *Canadian Aviation Regulations*.		
13b. Signature	13c. Approved Organization Number		14b. Signature		14c. Approved Organization Number
13d. Name	13e. Date (dd/mmm/yyyy)		14d Name		14e. Date (dd/mmm/yyyy)

(Previously form 24-0078)

Important: See notes on reverse side

Installer Responsibilities

This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown.

Figure 2 - Example of Completed Authorized Release Certificate

1 Approving Civil Aviation Authority/Country	2	3. Form Tracking No.
Transport Canada	AUTHORIZED RELEASE CERTIFICATE FORM ONE	AMI.16743

4 Organization Name and Address	5. Work Order/Contract/Invoice
Aviation Maintenance Inc., 123 Any St., Toronto, ON, Canada A1A 2Z2	AMI 2006-11/01

6 Item	7. Description	8. Part No.	9. Qty.	10. Serial/Batch No.	11. Status/work
1	Cylinder	7395723-22	6	3254681 3254682 3254683 3254684 3254685 3254686	Repaired

12 Remarks

Rebored 0.020" oversize, Nitrided, New valve guides and seats installed.

13a. Certifies that the items identified above were manufactured in conformity to:	14a. ☒ CAR 571.10 Maintenance Release
☐ approved design data and are in condition for safe operation	☐ Other regulation specified in block 12
☐ non approved design data specified in block 12.	Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, has been performed in compliance with the *Canadian Aviation Regulations*

13b. Signature	13c. Approved Organization Number	14b. Signature	14c. Approved Organization Number
		Jay Doe SCA 18	144-01
13d. Name	**13e Date (dd/mmm/yyyy)**	**14d Name**	**14e. Date (dd/mmm/yyyy)**
		Jay Doe	07-Feb-2009

(Previously form 24-0078)

Important: See notes on reverse side

Installer Responsibilities

This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown.

APPENDIX K – TRAINING TO PERFORM SPECIFIC NON-DESTRUCTIVE TESTING (NDT) TASKS

(amended 2007/12/30)

(refer to subsection 571.02(3) and 571 Schedule I of the CARs)
(amended 2007/12/30)

(1) Purpose
(amended 2007/12/30)

This appendix prescribes alternative training requirements that may be used as a basis of qualification for technicians performing certain kinds of Non-Destructive Testing (NDT) tasks, as an alternative to certification in accordance with national standards.

(2) Limitations
(amended 2007/12/30)

(a) The provisions of this appendix apply only to NDT using liquid penetrant, magnetic particle, ultrasonic and eddy current methods.

(b) NDT conducted under the provisions of this appendix is limited to the inspection of specified components for predictable discontinuities. The inspections must have clear, objective acceptance criteria.

Information Note*: These relatively restricted privileges differ from those of NDT AMOs and holders of CGSB and other nationally recognized standards, who need not be limited to the inspection of particular components, and may be granted broad privileges within the scope of the methods for which they are rated.*

(3) Training providers
(amended 2007/12/30)

Organizations or persons providing training in accordance with this appendix shall be:

(a) NDT training institutes providing training to national standards;

(b) Approved Maintenance Organizations holding appropriate NDT ratings; or

(c) Persons authorized by the holder of an aeronautical product type certificate for the product concerned.

(4) Scope of Training
(amended 2007/12/30)

(a) The training shall include, for each NDT method involved, an outline of theory equivalent to that specified for CGSB Level 1, insofar as it relates to the range of components the technician will be authorized to inspect.

(b) The training shall cover the application of the theory to the specific components the technician will be authorized to inspect. Where several similar items are involved, the training need not involve every configuration or part number affected, provided the samples used in the training are representative of the group as a whole.

(c) The training provider shall test each trainee, by written and practical examination, using sample aeronautical products representative of those listed on the certificate of training. The examiner shall ensure that the technicians are capable of carrying out the inspections satisfactorily without supervision.

(5) Documentation
(amended 2007/12/30)

(a) The training provider shall provide each graduate with documentation confirming his or her successful completion of the training, indicating the specific NDT tasks and components on which the trainee has demonstrated competence.

(b) The training documentation specified in paragraph (a) shall be retained by the trainee and, where the trainee is employed within an Approved Maintenance Organization, the organization shall retain a copy of the document on the trainee's record of training and experience, together with a description of the scope of NDT work he or she is authorized to perform within the organization.

(6) Persons eligible
(amended 2007/12/30)

Persons performing NDT under the provisions of this appendix must be either:

(a) The holder of an applicable AME license issued under Subpart 403 of the CARs; or

(b) The holder of an applicable Aircraft Certifying Authorization or Shop Certifying Authorization issued by an Approved Maintenance Organization.

(7) Recurrent training
(amended 2007/12/30)

(a) Where the technician is employed by an AMO, update training shall be conducted under the AMO's training program, at whatever frequency may be found necessary in response to the findings of the AMO's internal quality assurance audits.

(b) Technicians who are not employed by an AMO shall undergo update training every two years.

(c) Update training shall be provided by a training provider as identified in subsection (3).

(d) The scope of the update training shall take into account the technician's recent experience in the performance of NDT since the last training received.

(e) To enable the assessment of recent experience during update training as required by paragraph (c) the technician shall maintain a record of each inspection carried out under this appendix, including dates, times, location, equipment used, aeronautical product identity, and other pertinent information.

APPENDIX L - MAJOR REPAIR OR MAJOR MODIFICATION REPORT
(amended 2002/09/01)

(refer to section 571.12 of this standard)

1. This appendix provides information related to the use of a Major Repair or Major Modification Report, for reporting a major repair or a major modification to aircraft.

2. Section 571.12 of the CARs requires that when an aircraft has undergone a major repair or major modification, the actions shall be reported to the Minister. Routine changes of landing gear configuration, or role equipment are exempt from the reporting requirement.

3. A copy of the report must be completed and, except as provided in section 6 below, sent to the Transport Canada Centre assigned to the geographical area in which the owner of the aircraft resides or manages his business within 30 days after the aircraft is returned to service.

4. All entries must be typewritten or clearly printed in block letters in permanent ink.

5. Transport Canada does not publish a Major Repair or Major Modification Report form. The report may be reproduced by the user as a printed form or in computer generated format. User produced forms must comply with the format provided herein, including block numbers and must have the blocks located as per the layout provided. The size of the blocks may be varied to suit individual applications, but not to the extent that would make the report unrecognizable.

6. In the case of an air operator, an alternate reporting system described in a Maintenance Control Manual approved pursuant to Subpart 706 of the CARs satisfies the procedures set out in section 571.12 of this standard.

Completion of the Report by the Originator

Except as otherwise stated in these instructions, there must be an entry in each block.

Refer to the attached sample of a Major Repair or Major Modification Report.

Block 1 Aircraft

Enter the "Make", "Model" and "Serial Number" as found on the manufacturer's identification plate.

Block 2 Owner

Enter the aircraft owner's complete name and address as shown on the certificate of registration for the aircraft. The "Nationality and Registration Mark" must be the same as shown on the aircraft certificate of registration or affixed to the aircraft.

Block 3 Type of work

Enter a check mark (✓) in the appropriate box to indicate whether the aircraft was repaired or modified.

Block 4 Person / Organization who accomplished the repair or modification

Enter the name and permanent address of the person or organization who accomplished the repair or modification.

Information Note:

The maintenance release is completed in the applicable aircraft technical records, together with the complete details of the repairs or modifications performed.

Block 5 Description of work accomplished

This block must contain a clear, concise, and legible statement describing the work. It is important that locations of repairs or modifications, relative to the aircraft be included in the description. Work resulting in acoustical changes must be emphasized. If necessary, complete the description of the work accomplished on the reverse side of the report or attach additional sheets to it. In the latter case, indicate in block 5 that additional sheets are attached, inscribe on each sheet the aircraft registration marks and the date the work was completed.

Sample

MAJOR REPAIR OR MAJOR MODIFICATION REPORT RAPPORT DE RÉPARATION MAJEURE OU DE MODIFICATION MAJEURE

INSTRUCTIONS
For instructions, see Standard 571 Appendix L - Pour les instructions, consulter l'appendice L à la norme 571

1 Aircraft - Aéronef	Make - Marque Serial No. - N° de série	Model - Modèle
2 Owner - Propriétaire	Name - Nom	Registration Marks Marques d'immatriculation

3 Type of Work - Type de Travail

☐ **Modification** ☐ **Repair - Réparation**

4. **Name and address of person or organization who accomplished the repair or modification**
Nom et adresse de la personne ou de l'organisme qui a effectué la réparation ou la modification

5. Description of work accomplished - Description des travaux exécutés

Signature of person submitting the report - Signature de la personne soumettant le rapport

Date of completion - Date d'achèvement

APPENDIX M - ON TYPE MAINTENANCE TRAINING COURSES

(amended 2000/12/01)

[subsection 571.11(4) of the CARs refers]

1. This appendix sets out the specifications for the course of maintenance training, hereinafter called a type course, that is required pursuant to subsection 571.11(4) of the CARs.

Information Note:

Type courses are intended to provide Aircraft Maintenance Engineers with the necessary level of knowledge to sign a maintenance release for the type of aircraft, engine or avionics system concerned.

2. An approved training organization (ATO) or an approved maintenance organization (AMO) may be authorized by the Minister to provide type courses provided that the organization publishes, subject to section 10, the specifications of this appendix in its policy manual, and:

(a) is the holder of an applicable ATO certificate issued pursuant to section 403.08 of the CARs, and conforms to Division II of Standards 566; or

(b) is, subject to section 4, the holder of an applicable AMO certificate, issued pursuant to section 573.02 of the CARs, and complies with the specifications set out below.

3. Where the Minister authorizes an AMO to provide type courses, the authorization shall be limited to training employees of the AMO.

4. In order for an AMO to be authorized to provide a type course to self-employed AMEs, or to AMEs employed by another organization, the AMO shall hold an ATO certificate issued pursuant to section 403.08 of the CARs.

On Type Maintenance Training Specifications Applicable to AMOs

5. **Prerequisites**

An AMO requesting authorization to provide type courses, shall establish competency prerequisites to ensure that students to be enrolled in the course are capable of understanding the course material.

6. **Training outline**

(a) Except for the requirements of section 566.10 of Standard 566, the training outline standards specified in subsections 566.18(1) to (7) inclusive shall be met by the AMO.

(b) The length of the aircraft, airframe, engine or avionics system type course shall be determined by the complexity of the type involved and, in all cases, shall be of a reasonable duration to ensure that the course objectives are met.

(c) In the case of a type course on a specific aircraft type, the curriculum shall cover the entire aircraft including airframe, engine interface, engine, propeller and avionics systems.

(d) Upon successful completion by a student of a course referred to in paragraph (c), the AMO shall provide a certificate to the student attesting that the student has met the training requirements in respect of the aircraft type and specifying the applicable engine type covered by the course.

7. **Facilities**

An AMO shall provide or have access to facilities appropriate to the course content requirements, except that:

(a) if simulators or mock-ups are used, they shall be located in a separate area of sufficient space to contain this equipment in an acceptable fashion for display, inspection and operation; or

(b) if aircraft are used, hangar facilities shall provide sufficient space to contain an aircraft and required shop equipment to either:

(i) disassemble, inspect, maintain, overhaul, adjust and assemble aircraft; or

(ii) locate, inspect, troubleshoot, perform functional testing and explain the function of various areas and components of an aircraft.

8. **Reference Material**

An AMO shall develop a course training manual containing all the subject material covered and provide each student with a copy thereof, and shall ensure that the following publications are available to students and maintained up-to-date:

(a) Maintenance Manual;

(b) Overhaul Manual;

(c) Structural Manual;

(d) Parts Manual;

(e) Bulletins or Instructions; and

(f) Airworthiness Directives.

9. **Class Size**

The number of students enrolled in the course shall be consistent with the size of the room and the kind of equipment utilized for the presentation of the course material, where each student is provided reasonable workspace, with an unobstructed view of all presentations and training aids.

10. **One Time Delivery of Type Courses**

(a) An AMO may, under special circumstances, request authorization for a one time (one-off) delivery of a type course for each particular aircraft type, in which case a formal amendment to its policy manual is not required, provided that supporting documentation is submitted to the Minister prior to obtaining approval, indicating the alternative methods of compliance to the course specifications.

(b) Subsequent type courses provided by the AMO, shall conform to all the course requirements applicable to the provision of on type maintenance training under this appendix.

Transport Canada / Transports Canada

TP 6197E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

STANDARD 573 - APPROVED MAINTENANCE ORGANIZATIONS

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa (Ontario)
KIA OS9

Telephone: (613) 941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: (613) 954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: http://publications.gc.ca

Catalogue No.: T51-15/573-2005E-S

NOTE

All amendments to the CARs will be indicated by the Coming into Force date, immediately following the amended text.

RECORD OF AMENDMENTS

Date of Amendment	*Date Entered*	*Entered by*
2005/05/31	Apr. 18/06	[illegible]
2009-2 (2009/[illegible]/01)	2012/03/[illegible]	[illegible]
2010-2 ([illegible])	" "	[illegible]
2010-1 ([illegible])	"	[illegible]
2011-2 ( )	" "	[illegible]

Date of Amendment	*Date Entered*	*Entered by*

STANDARD 573 - APPROVED MAINTENANCE ORGANIZATIONS

Table of Contents

PART V - AIRWORTHINESS

STANDARD 573 - APPROVED MAINTENANCE ORGANIZATIONS

Information Notes:

(i) In these standards, "the person responsible for maintenance" means the person appointed by the holder of an approved maintenance organization (AMO) certificate under section 573.03(1)(a) of the Canadian Aviation Regulations *(CARs).*
(amended 2005/05/31)

(ii) Unless otherwise explicitly indicated, nothing in the regulations, or this standard, requires the AMO to adopt the titles of the approved manuals, positions and programs used in the regulatory documents. The designations expressed are meant to facilitate the drafting of the applicable regulations and standards. Approved organizations are free to use any designation they wish, provided the pertinent regulations and standards are complied with.
(amended 2005/05/31)

(iii) Where the holder of an AMO Certificate also holds any other certificate which requires an approved manual, a separate manual can be provided with respect to each separate approval.

(iv) Where the certificate holder chooses to combine these separate manuals, it can be done provided that each division of the manual identifies its source regulation (e.g. combined AMO-Air Operator manual can be divided into Division I for the AMO, and Division II for the air operator requirements).

(v) Conversely, a combined AMO-Air Operator manual can also be fully integrated, providing that a statement is included for each section of the manual to indicate whether that particular section is intended as a means of compliance with Subpart 573 or Subpart 706 of the CARs.

(vi) In addition, a combined manual can also be fully integrated with no reference to applicable source regulations. However, in such a case, should the Minister be required to take action against a certificate in respect of which a combined manual is in effect, the Minister will have to take action against both certificates if a clear distinction within the affected sections cannot be made.

(vii) An aircraft AMO may be rated for any type of aircraft for which it is able to demonstrate the ability to properly perform the scope of maintenance covered by the rating and limitations requested. The aircraft need not be of a type that has been type certificated by Transport Canada.
(amended 2001/06/01)

(viii) Aircraft AMO certificates and ratings are issued to authorize the performance of maintenance (other than specialized maintenance) on aircraft operated in commercial service pursuant to CARs Part IV and Part VII, and upon components intended for installation on such aircraft; however an AMO is not limited to the maintenance of aircraft so operated, and may also perform non-specialized maintenance on privately

operated aircraft and components thereof.
(amended 2001/06/01)

(ix) Specialized AMO certificates and ratings are issued either to authorize the performance of specialized maintenance of the kind specified on the certificate, or to authorize the performance of non-specialized maintenance upon aircraft operated in commercial service pursuant to CARs Part IV and Part VII, or upon components intended for installation on such aircraft. However, an AMO that is approved for the performance of specialized maintenance is not limited to such work, and may also perform non-specialized maintenance of the kind described on its AMO certificate.
(amended 2001/06/01)

573.01 *Application for Approval*

(1) An AMO applying for an amendment to its existing AMO approval that affects the procedures contained in the existing approved MPM shall submit the text of the proposed amendment. In cases where the existing MPM requires such extensive revision as to make this impractical, the AMO Certificate holder shall supply a new draft in the existing approved MPM, shall supply the text of the amendment to the MPM that meets the requirements of Subpart 573 of the CARs.

Sample Form #24-0070

Transport Canada / Transports Canada

APPLICATION FOR APPROVAL OF A MAINTENANCE ORGANIZATION / DEMANDE D'AGRÉMENT D'ORGANISME DE MAINTENANCE

1. Name of Applicant / Nom du demandeur

3. Type of Application / Genre de demande
☐ Initial / Originale ☐ Amendment / Modification

2. Address / Adresse

4. Approval Number / Numéro d'agrément

Postal Code / Code postal | Telephone No. / N° de téléphone | Fax No. / N° de télécopieur

5. Ratings / Specialités
☐ Aircraft / Aéronef
☐ Avionics / Avionique
☐ Instruments / Instruments
☐ Engines / Moteurs
☐ Propellers / Hélices
☐ Structures / Cellules
☐ Components / Composants
☐ Welding / Soudure
☐ Nondestructive Testing / Essais non destructifs
☐ Other / Autre

6. Details Regarding Ratings Requested (For Aircraft, Specify Type)
Détails concernant les spécialités demandées (pour aéronef, préciser les types)

7. Managment Personnel (Attach Resumes) / Personnel de gestion (rejoindre c.v.)

Accountable Executive / Gestionnaire supérieur responsable ____________

Person Responsible For Maintenance / Personne responsable de la maintenance ____________

Person Responsible For Quality / Personne responsable de la qualité ____________

8. Maintenance Personnel (Minimum Numbers) / Personnel de maintenance (nombre minimum)

Licenced AMEs / Titulaires d'une licence TEA ☐

Technicians / Techniciens ☐

Technical Support / Soutien technique ☐

9. Declaration: The above information and that contained in the maintenance policy manual and other supporting documentation is a true and accurate description of the organization.
Déclaration : Les renseignements donnés ci-dessus, ainsi que ceux contenus dans le manuel de politiques de la maintenance et dans les autres documents pertinents décrivent l'organisme avec exactitude et fidelité.

Correspondence is requested in / Langue utilisée dans la correspondance
☐ English / Anglais ☐ French / Français

(Name and title of person authorized to sign on behalf of the organization)
(Nom et fonction de la personne habilitée à signer au nom de l'organisme)

Date (yyyy-mm-dd) / Date (aaaa-mm-jj)

DOT USE ONLY / RÉSERVÉ AU MDT

10. Evaluation of proposed Maintenance Control System
Évaluation de la proposition de programme de contrôle de la maintenance

☐ Safety Management System Requirements / Exigences relatives au système de gestion de la sécurité
☐ Maintenance Policy Manual / Manuel de politiques de maintenance
☐ Management Personnel / Personnel de gestion
☐ Maintenance Personnel / Personnel de maintenance
☐ Quality Assurance Program / Programme de contrôle de la qualité
☐ Training Program / Programme de formation
☐ Facilities / Installations
☐ Equipment / Équipment
☐ Subcontracts / Sous-traitance

The proposed maintenance control system meets the requirements of the *Canadian Aviation Regulations*.
La proposition de programme de contrôle de la maintenance conforme aux exigences du *Règlement de l'aviation canadien*.

Civil Aviation Safety Inspector / Inspecteur sécurite de l'aviation civile

Date (yyyy-mm-dd) / Date (aaaa-mm-jj)

11. Recommendations: The organization has been inspected (see separate inspection report) and is recommended for approval with the following ratings:
Recommandation : L'organisme à fait l'objet d'une inspection (voir le rapport distinct) et nous recommandons qu'il soit agréé dans les domaines suivants :

☐ Aircraft / Aéronefs
☐ Avionics / Avionique
☐ Instruments / Instruments
☐ Engines / Moteurs
☐ Propellers / Hélices
☐ Structures / Cellules
☐ Components / Composants
☐ Welding / Soudure
☐ Nondestructive Testing / Essais non destructifs
☐ Other / Autre

Details (For Aircraft, Specify Type) / Détails (pour Aéronefs, préciser les types)

Civil Aviation Safety Inspector / Inspecteur sécurité de l'aviation civile

Date (yyyy-mm-dd) / Date (aaaa-mm-jj)

24-0070 (1103-05)

Canada

Completion Instructions

Reserved

573.02 *AMO Certificates*

(1) An AMO Certificate is issued with ratings in one or more of the following categories:

(a) Aircraft;

(b) Avionics;

(c) Instrument;
(amended 2001/06/01)

(d) Engine;

(e) Propeller;

(f) Structure;

(g) Component;

(h) Welding; and

(i) NDT.

Information Notes:

(i) Specific NDT tasks can be performed without an AMO category in the NDT category where the NDT is performed in accordance with Appendix K of Standard 571.

(ii) No AMO category is available for special processes such as machining, grinding, electro-plating, metalizing, etc. Where these processes are performed as part of the maintenance of an aeronautical product, they must be carried out under the control of an AMO with a category for that product. The AMO is responsible for the conformity of the work carried out (special process) to the applicable design standard for that product. Where work is sent to an external agent, a maintenance arrangement meeting the applicable requirements of subsection 573.11(2) of the CARs is required.
(amended 2001/06/01)

(iii) Work carried out that includes specialized maintenance may include both off-aircraft and on-aircraft work where indicated in the appropriate limitations. The provisions of Subparts 571 and 573 of the CARs will apply to any person who is authorized to issue a maintenance release for work conducted on aircraft.
(amended 2001/06/01)

(iv) The scope of work section of the MPM may indicate use of an "incorporated by reference lists of components". This referenced list could be a listing of current technical publications, that is already included as an appendix to the MPM.
(amended 2001/06/01)

(v) The aircraft type and models specified in the scope of work section of the MPM, should be as specific or wide in range as necessary to reflect the organization's capabilities.
(amended 2001/06/01)

(2) Ratings in the aircraft category are issued to authorize the performance of work, other than specialized maintenance, on aeroplanes and helicopters operated under a flight training unit Operator Certificate or on aircraft that are operated under an air operator Certificate. Other AMO categories are issued to authorize the performance of specialized maintenance that is beyond the privileges of an AMO with only an aircraft category. AMOs with specialized categories can also undertake non-specialized maintenance, provided that the work is covered by the product or the process included in the specialized category held. AMOs may also perform maintenance on privately operated aircraft, and on foreign aircraft, subject to compliance with the applicable regulations of the state of registry.
(amended 2001/06/01)

(3) A rating in the aircraft category will specify one or more types or groups of aircraft that are eligible to be maintained. Each type or group will be further subject to one of these limitations:

(a) Non-specialized

Any maintenance on the aircraft of the types specified, or any of their component parts, provided the maintenance is not specialized maintenance under the provisions of Schedule II of Subpart 571 of the CARs.
(amended 1998/06/01)

(b) Check Limited

Any type of maintenance required to accomplish the level of check or inspection indicated on the limitations sheet, including the rectification of defects on the aircraft types specified, provided the maintenance is not specialized maintenance under the provisions of Schedule II of Subpart 571 of the CARs.
(amended 1998/06/01)

(c) Line Maintenance

Maintenance of the specified aircraft types is limited to pre-flight, daily and weekly checks, and includes the rectification of aircraft defects, provided the maintenance is not specialized maintenance under the provisions of Schedule II of Subpart 571 of the CARs. A line maintenance limitation does not include any scheduled checks that include segmented portions of higher level checks.
(amended 1998/06/01)

(4) Ratings in the Avionics category are issued in respect of the incorporation of a modification which provides for the installation of one of the following types of equipment into an aircraft, or the repair or modification of one of the following categories of avionics equipment:
(amended 2001/06/01)

(a) Radio

The radio rating includes:
(amended 2001/06/01)

(i) all RF receivers or transceivers including Emergency Locator Transmitters (ELT) and Underwater Locating Devices (ULD);

(ii) Air Traffic Control (ATC) transponders (not including the aneroid sensing devices used in altitude reporting systems);

(iii) radar;

(iv) Distance Measuring Equipment (DME);

(v) radar altimeters;

(vi) Traffic Collision Avoidance Systems (TCAS);

(vii) Ground Positioning Warning Systems (GPWS); and

(viii) Flight Data Recorders (FDRs) and Cockpit Voice Recorders (CVRs).

(b) Autoflight

The autoflight rating includes any device used in an autoflight or flight path computation systems, including flight guidance computers and their associated display devices.
(amended 2001/06/01)

(5) Ratings in the instrument category are issued in respect of the following display devices and associated systems, except where their operation is integrated with a device to which another rating applies:
(amended 2001/06/01)

(a) gyroscopic instruments;
(amended 2001/06/01)

(b) pitot-static instruments including aneroid sensing devices used in altitude reporting systems; and
(amended 2001/06/01)

(c) any other instrument or display device.
(amended 2001/06/01)

Information Note:

As examples: a Course Deviation Indicator (CDI) within a Loran-C is a display device within a device which would fall under a Radio rating; the ID-802 advisory display in the SPZ-8000 auto-pilot (DHC-8) is a display device which would fall under the auto-flight rating.
(amended 2001/06/01)

(6) Ratings in the Engine category are issued in respect of the maintenance of one or more types or groups of engines.
(amended 2001/06/01)

Information Note:

Holders of a certificate endorsed with an engine category can perform any maintenance on the engine types or groups listed on the certificate, including maintenance to those aeronautical products that are driven by the engine, but excluding propellers and external gearboxes not forming part of the engine type design.

(7) Ratings in the Propeller category are issued in respect of one or more types or groups of propellers.
(amended 2001/06/01)

(8) Ratings in the Structure category are issued in respect of the repair or modification of structures of the following kinds:
(amended 2001/06/01)

(a) Wooden

A wooden structure rating covers all repairs and modifications to wooden structure and includes the repair or making of any metal attachment bracket forming part of the structure, provided that welding is not required. This includes the repair of laminated structures, including metal sheathed laminated structures, provided the core material is wood.

(b) Sheet Metal

A sheet metal structure rating covers all repairs and modifications to sheet metal structures including airframes, floats, and skis, and includes the repair of metal sheathed honeycomb structures. This rating does not include repairs to tubular structures within sheet metal aircraft

(c) Tubular

A tubular structure rating covers all repairs and modifications to tubular metal structures. This rating will not be issued unless the applicant also holds a rating for Tig, Mig or Oxy-acetelyne welding, as applicable to the type of structure being repaired. A tubular structure rating includes the repair of tubular engine mount assemblies.

(d) Composite

A composite structure rating covers all repairs and modifications to composite structures, including any integral bonded metal members or fasteners. This rating also covers the repair of metal or wood sheathed laminated structures.

Work carried out under these ratings includes on-aircraft work where indicated in the appropriate limitations. Where on-aircraft work is authorized, the provisions of Subparts 571 and 573 of the CARs will apply to any person who is authorized to issue a maintenance release for work conducted on an aircraft.

Information Note:

The term "Composite Structures" means structures composed of plastic resin materials reinforced by non-metallic fibres. These include, but are not limited to graphite, aramid (kevlar), and glass fibre filaments. Metal sheathed honeycomb is a sheet metal structure, whereas metal/wood sandwich board is a wooden structure.

(9) Ratings in the Component category are issued in respect of the maintenance of one of the following categories of components:
(amended 2001/06/01)

(a) hydraulic or pneumatic power valves, or power packs;

(b) fuel metering or air metering components;

(c) pressure type fuel, oil, pneumatic or hydraulic pumps;

(d) speed regulating governors, including engine or propeller governors and constant speed drives;

(e) power train components. This includes rotor-heads, transmissions, and those mechanisms used to transmit power to the rotor of a rotary wing or tilt wing aircraft;

(f) rotor blades;

(g) aircraft magnetos;

(h) bladder type fuel tanks; and

(i) electrical components used in power generation, distribution or control, including:

(i) motors, switches and solenoids;

(ii) heating and lighting devices;

(iii) galley components; and

(iv) any other devices using electricity as their primary source of power, that do not form part of any other rating.

Information Note:

Holders of an aircraft category can perform maintenance on the aircraft components that are approved for installation on aircraft included in the AMO rating, provided the maintenance is not categorized as Specialized Maintenance under Schedule II of Subpart 571 of the CARs.
(amended 2001/06/01)

(10) Ratings in the Welding category are issued in respect of the repair or modification under one of the following processes:
(amended 2001/06/01)

(a) arc welding includes tungsten inert gas, metal inert gas, and other general arc techniques;

(b) resistance welding includes spot and seam welding;

(c) gas welding; and

(d) electron Beam welding.

(11) An AMO with ratings in the Aircraft, Avionics, Engine, Propeller, Structure, or Component categories may evaluate undocumented parts of the kinds listed on the pertinent ratings, provided that:
(amended 2002/03/01)

(a) the AMO establishes applicable procedures, in its MPM, to perform the process outlined in Standard 571, Appendix H;

(b) the AMO obtains approval for the procedures required in paragraph (a) in accordance with section 573.01 of the CARs, and

(c) the performance of such service is authorized in the limitations set out in the AMO certificate.

(12) Ratings in the NDT category are issued in respect of inspection of aeronautical products using one of the following methods:
(amended 2001/06/01)

(a) Liquid Penetrant Inspection includes fluorescent and non-fluorescent methods;

(b) Magnetic Particle Inspection includes fluorescent and non-fluorescent methods;

(c) Eddy Current Inspection includes inspection methods conducted using equipment relying on eddy current technology;

(d) Ultrasonic Inspection includes contact, immersion, and through transmission techniques; and

(e) Radiographic Inspection includes methods using X-Ray, Gamma and Neutron radiation sources.

(13) An AMO certificate will not be subject to an expiry date except where the certificate is issued to an organization that is wholly located outside of Canada; in such a case, the certificate will be issued with an expiry date that is 2 years following the date of issue.
(amended 2002/03/01)

Information Note:

Certificates issued to foreign AMOs are not renewable; a new application is required prior to the issue of a new certificate.

573.03 *Reserved*
(amended 2005/05/31)

573.04 *Person Responsible for Maintenance*
(amended 2005/05/31)

(1) The person responsible for maintenance appointed under paragraph 573.03(1)(a) of the *Canadian Aviation Regulations* (CARs) shall have acquired a minimum of six years experience in the performance or direct supervision of maintenance activities of the type undertaken by the organization, at least six months of which have been obtained within the preceding two years.
(amended 2005/05/31)

(2) An applicant for the "Person Responsible for Maintenance" position within an AMO shall demonstrate, during an interview to be conducted by Transport Canada regional personnel, that he or she is knowledgeable in respect of the AMO's policies approved by the Minister, and the topics below:
(amended 2005/05/31)

(a) duties and responsibilities of the appointed position;

(b) duties of persons who have been assigned functional responsibilities;

(c) responsibilities of the AMO in relation to those of the operator;

(d) responsibilities of the AMO for work that has been contracted out;

(e) responsibilities of ACA/SCA holders in relation to those of the AMO;

(f) the function of Quality Assurance;

(g) maintenance release requirements;

(h) record keeping requirements;

(i) identification of acceptable reference data for repairs and modifications;

(j) parts control and traceability; and

(k) control of non conforming parts and materials.

(3) The interview is designed to establish the applicant's knowledge. Questions and responses will be recorded.
(amended 2005/05/31)

573.05 *Qualifications for Signing a Maintenance Release*

Information Note:

An AME licence does not automatically qualify an individual to sign a maintenance release under an AMO authority. The authority for a person to sign a release within the AMO's jurisdiction shall be separately granted by the AMO, in acordance with section 573.07 of the CARs, following specific training in regards to AMO procedures and other regulatory training.

(1) Pursuant to section 573. 05 of the CARs, an AMO shall issue an authorization to those individuals who will sign a maintenance release in respect of work performed on an aircraft.

Information Notes:

(i) This type of authorization is commonly known as an Aircraft Certification Authority (ACA). An ACA also permits the certification of work that is performed off the aircraft, provided it is not prohibited in the MPM. This work is only appropriate under an ACA where it is performed on products that are, by type design, eligible for installation on the aircraft or system for which the AME licence, forming the basis of the ACA, is rated.

(ii) "Eligible" does not necessarily mean that the part is intended to be installed on an aircraft for which the AME licence is rated; the part may be eligible, by type design, to be installed in several aircraft types. Provided the part is eligible for installation in the type for which the AME licence has been rated, the work can be performed even though the part may actually be installed on an aircraft for which the AME licence has not been rated.

(2) An AMO authorizes a person, that is not the holder of an AME licence issued pursuant to CAR 403, to sign a maintenance release, in accordance with paragraph 571.11(2)(c) of the CARs, in respect of work performed on parts intended for installation on an aircraft, by means of a Shop Certification Authority (SCA). Prior to the issuance of an SCA, the AMO shall ensure that the person understands his/her responsibilities in accordance with the applicable regulations, and has demonstrated levels of knowledge and experience that meet the applicable requirements of section 573.05 of the CARs, in respect of the work certified. These levels of knowledge and experience can be determined as follows:
(amended 2002/03/01)

(a) by diploma or certificate from a course in an appropriate field or by an attestation that the person has been working in the field, under the supervision of an ACA or SCA holder for a period of not less than:

(i) in the case of engine or propeller overhauls, 1800 hours; and

(ii) in all other cases, including the repair of engine modules, 300 hours.

(3) Prior to issuing an authorization in respect of the evaluation of undocumented aircraft parts, the AMO shall ensure that the person has been exercising the privileges of an appropriate ACA or SCA for a period of not less than 5 years, and has successfully completed an approved course of training on the applicable process outlined in Standard 571, Appendix H.
(amended 2002/03/01)

Information Note:

The five year experience requirement mentioned in (3) does not necessarily represent the experience gained within a single AMO, but can be the cumulative pertinent experience gained within a number of AMOs.
(amended 2002/03/01)

(4) Performance of specific NDT tasks can be authorized by AMOs not holding an NDT category provided that the tasks are performed as set out in Standard 571, Appendix K.

(5) ACA or SCA authorization are indicated in a document issued to each individual concerned; the identity of each person shall also be established in the records required by section 573.07 of the CARs. In the case of an SCA, the records shall include details in respect of (2)(a) above.

573.06 *Training Program*

(1) Pursuant to subsection 573.06(1) of the CARs, an AMO certificate holder shall ensure that all staff with technical responsibilities are provided appropriate training in technical, regulatory and human factors issues related to the work for which they are responsible.
(amended 2002/09/01)

(2) The training program shall include:
(amended 2002/09/01)

(a) initial training to ensure that persons taking on new responsibilities are aware of their technical, administrative, and regulatory responsibilities;
(amended 2002/09/01)

(b) update training to ensure that personnel remain competent and are made aware of any change to their area of responsibility;
(amended 2002/09/01)

(c) additional training where it is shown to be necessary by a finding made under the quality assurance program or required due to changes in the regulations, applicable standards, or company procedures; and
(amended 2002/09/01)

(d) procedures to ensure staff are kept aware of maintenance safety related issues in general, by means of bulletin boards, information notices, company publications, verbal briefings, or by similar means.
(amended 2002/09/01)

Infomation Note:

These training requirements are intended to apply mainly to those persons performing and certifying maintenance. With the exception of a minimum regulatory knowledge of their responsibilities, it is not intended that the thrust of the training be aimed at personnel whose functions are limited to management.

(3) Human factors training shall include instruction in:
(amended 2002/09/01)

(a) human performance;
(amended 2002/09/01)

(b) factors influencing human error, including:
(amended 2002/09/01)

(i) fatigue;

(ii) stress;

(iii) assertiveness;

(iv) awareness;

(v) resources;

(vi) knowledge;

(vii) team work;

(viii) norms (commonly accepted standards and procedures);

(ix) complacency;

(x) pressure;

(xi) distraction; and

(xii) communication;

(c) error management, including error prevention and error containment.
(amended 2002/09/01)

(4) The AMO certificate holder shall ensure that sufficient examinations or practical evaluations are administered to determine whether students have achieved the learning objectives of the training provided.
(amended 2002/09/01)

(5) Until such time as it is revised through an assessment made in respect of the quality assurance program required by section 573.09 of the CARs, the initial cycle for update training shall not exceed three years.
(amended 2002/09/01)

(6) Pursuant to section 571.11 of the CARs, prior to authorizing ACA privileges for any transport category aeroplane or turbine powered helicopter, the AMO shall ensure the AME has successfully completed a Transport Canada approved training course on the type of aircraft, engine or system concerned. Where formal classroom type-training is not reasonably available, training can be provided through an on-the-job (OJT) training program, set out in the MPM, that is conducted in accordance with a structured, documented plan that covers in its entirety the aircraft, the engine or the system.
(amended 2002/09/01)

(7) Prior to authorizing ACA privileges for non-transport category aircraft, the AMO shall develop a means of testing and recording the AME's knowledge and skill on all applicable aircraft systems, and on a representative selection of practical tasks.
(amended 2002/09/01)

(8) Training of maintenance safety personnel
(amended 2005/05/31)

The person responsible for maintenance and all personnel assigned duties under the safety management system established pursuant to section 573.30 of the CARs shall successfully complete a safety related initial training course that includes the following subjects:
(amended 2005/05/31)

(a) maintenance and flight safety philosophy;

(b) human factors;

(c) accident prevention;

(d) the responsibilities of maintenance safety personnel;

(e) risk management;

(f) accident/incident reporting; and

(g) incident investigation.

573.07 *Personnel Records*

Information Notes:

(i) The personnel records required by section 573.07 of the CARs are to be retained for a period of not less than 2 years after an entry is made.

(ii) A list of authorizations issued pursuant to requirements of Subpart 573 of the CARs can be kept as a separate list from the MPM.

Pursuant to subsection 573.10(3) of the CARs, where the list of authorizations is kept as a separate list from the MPM, the list is to be incorporated by reference in the MPM

573.08 *Facilities and Equipment*

(1) For the purposes of this standard, equipment includes:
(amended 2002/09/01)

(a) up to date copies of pertinent technical and regulatory information, including;
(amended 2002/09/01)

(i) the operator's aircraft maintenance schedule,
(amended 2002/09/01)

(ii) aircraft maintenance manual,
(amended 2002/09/01)

(iii) structural repair manual,
(amended 2002/09/01)

(iv) supplementary structural inspection document,
(amended 2002/09/01)

(v) corrosion control document,
(amended 2002/09/01)

(vi) service bulletins,
(amended 2002/09/01)

(vii) service letters,
(amended 2002/09/01)

(viii) service instructions,
(amended 2002/09/01)

(ix) modification leaflets,
(amended 2002/09/01)

(x) NDT manual,
(amended 2002/09/01)

(xi) parts catalogue,
(amended 2002/09/01)

(xii) type certificate data sheet, and
(amended 2002/09/01)

(xiii) any other specific document issued by the type certificate or supplementary type certificate holder;
(amended 2002/09/01)

Information Note:
Section 573.08 of the CARs indicates that the data available on site has to be proportionate to the scope of work undertaken. For example, the technical and regulatory data required where line maintenance is being performed would not be the same as in a facility dedicated to a full range of scheduled maintenance.
(amended 2002/09/01)

(b) hand tools;

(c) jigs;

(d) fixtures;

(e) work stands;

(f) test equipment;

(g) calibrated tools;

(h) hoists;

(i) jacks;

(j) ladders;

(k) portable lighting;

(l) electrical power supplies;

(m) hydraulic or pneumatic ground support equipment.

(2) Section 573.08 of the CARs requires the AMO certificate holder to provide detailed information on the various locations where aircraft maintenance is to be performed. For the purpose of these standards, facilities shall include, as appropriate to the scope of work to be performed:
(amended 2002/09/01)

(a) lighted hangars;

(b) maintenance docks;

(c) workshops;

(d) clean rooms;

(e) secure storage facilities, protected from the elements, with a means of segregating serviceable and unserviceable parts;
(amended 2002/09/01)

(f) other housing and support facilities to enable maintenance to be performed in clean conditions, protected from the elements; and

(g) reasonable office accommodations for the management of maintenance systems.
(amended 2002/09/01)

(3) When the work is to be performed on the aircraft, all scheduled maintenance, including the rectification of defects whose repair has been deferred, shall be carried out in a hangar that is capable of completely enclosing the aircraft, where that work:

(a) is, in respect of a large aircraft, C, D or E checks, or any equivalent check scheduled at an interval greater than 12 months;

(b) except where otherwise specified by the manufacturer's maintenance manual for the aircraft type, involves the placing of the complete aircraft on jacks;

(c) requires the use of environmentally sensitive testing equipment, unless that equipment has been calibrated to take the environment into account; or

(d) involves the disassembly of components which would require lubrication upon re-assembly and could affect safety of the aircraft if exposed to contaminants such as dirt, water, sand, snow, etc.

Information Note:

Notwithstanding these standards, AMO Certificate holders are reminded that provincial standards and regulations, or where none exist the applicable national code, may specify minimum requirements applicable to lighting and other environmental factors in the work place.

(4) The facilities may be owned by the AMO, or be available through a lease agreement, provided the facilities are available on a "when needed" basis, or otherwise subject to pre-arranged periods of hangar availability. The contractual arrangements for the use of maintenance facilities must be set out clearly in the MPM or incorporated by reference. The arrangements must guarantee that the AMO will have access to the facilities when the need arises, particularly where other organizations hold contractual arrangements for the use of the same facilities.
(amended 2002/09/01)

(5) In the case where the AMO has agreed, through a maintenance arrangement, to perform maintenance for an air operator on an aircraft routinely operated away from the AMO's facilities (deployed operations), the MPM shall address provisions for outside work, paying particular attention to environmental factors such as those outlined in (2).

Information Note:

Some operators may be operating in remote areas for extended periods and it may not be feasible to return to the main base for scheduled maintenance. These operators must submit details of the level of maintenance that will be conducted and how the maintenance will be controlled, what temporary shelter will be provided, and any special procedures that will be instituted to ensure that maintenance conforms to the CAR requirements.

(6) Compliance with section 571.02 of the CARs performance rules requires that only the equipment recommended by the aeronautical product manufacturer, or its equivalent, be used to perform maintenance on an aeronautical product. To determine equivalence, an applicant shall compare performance criteria for the equipment and

ensure that the substituted equipment can provide at least the same output as the equipment recommended by the manufacturer.

(7) The equipment that the AMO has at its facilities or has access to as required shall include the technical and regulatory information consistent with the maintenance or services specified in the AMO categories and ratings, and the scope of work.

(8) Except for tools commonly available for commercial rental, all other pieces of equipment and information to which the AMO has access but which it does not own, shall be shown to be available by a contract or other documented agreement. The organization must be prepared to make available for inspection all facilities and equipment whether owned by the organization or otherwise.

573.09 ***Quality Assurance Program***
(amended 1998/06/01)

Information Note:

The Quality Assurance Program (hereinafter the program) established under section 573.09 of the Canadian Aviation Regulations *(CARs) is not intended to be based solely on a system of end product inspection, but rather upon periodic verifications of all aspects of the systems and practices used in the performance of maintenance. The program should provide an unbiased picture of the AMO's performance, to verify that activities and results comply with the MPM and confirm that the MPM and the systems and procedures described within it remain effective.*
(amended 2005/05/31)

(1) The program shall, as a minimum, cover all functions defined within the MPM and include all elements necessary to ensure effectiveness, quality and safety. It shall confirm that the AMO is in compliance with the applicable regulations and with the MPM by addressing operational and environmental conditions, organizational structure, record keeping systems, etc., and ensure that all referenced procedures remain applicable and effective.
(amended 2005/05/31)

(2) The audits referred to in paragraphs 573.09(3)(a) and (b) of the CARs may be conducted on a progressive or segmented basis, provided that the entire organization is audited within the applicable interval.
(amended 2005/05/31)

Information Note:

A proportion of random audits should be carried out while maintenance is in progress, including work being performed at night time.
(amended 2005/05/31)

(3) Activities related to the program may be performed by employees of the AMO or by external agents. Persons may be assigned responsibility for other duties, in addition to those related to the program, provided that the program responsibilities take precedence over all other responsibilities.
(amended 2005/05/31)

573.10 *Maintenance Policy Manual*

(1) Except where the information listed below is otherwise incorporated by reference pursuant to subsection 573.10(2) of the CARs, the maintenance policy manual (MPM) of a domestic AMO Certificate holder shall contain at least the following information, where it is appropriate to the product maintained or the work performed:

(a) a table of contents;

(b) the identity of the AMO, including the following information:

(i) the legal name of the organization and, where that name is not the name under which the organization does business, its trade name;

(ii) a brief description of the organization including the approximate size of the organization, the geographic location and general layout of the facilities required by section 573.08 of the CARs, in respect of which the application is being made;

(iii) the scope of work that is intended to be performed.

Information Note:

Where an AMO certificate is held by a person who is also the holder of an Air operator certificate, a general statement to that effect may be included in the general scope of work statement required by these standards.

(c) a statement signed by the AMO certificate holder confirming that the MPM and any incorporated document identified therein reflect the AMO certificate holder's means of compliance with the Regulations, as required by subsection 573.10(1) of the CARs;

(d) provisions for issuing and controlling amendments, including a description of the amendment procedure, to ensure compliance with subsections 573.10(5) and 573.10(8) of the CARs;
(amended 1998/06/01)

Information Note:

The statement authorizing the MPM document itself must be signed by the Accountable Executive, however the person responsible for maintenance appointed pursuant to section 573.04 of the CARs may authorize the submission of amendments or re-issue of the MPM to the Minister for approval.
(amended 2012/06/30)

(e) a means of identifying each page of the MPM that has been submitted for approval, as required by subsection 573.10(5) of the CARs. This shall be in the form of a List of Effective Pages, with each page numbered and either dated or marked with a revision number;

Information Note:

The amendment control pages in use prior to the publication of the Airworthiness Manual shall no longer be acceptable as the sole means of control for amendments to MPMs. Each page of a MPM shall be linked, by a page number and either a date or a revision number, to a list that identifies the most recent date of issue for that page.

(f) a description of the system used to distribute the manual, including the name or title of each person who holds a copy of the manual, to ensure compliance with subsection 573.10(7) of the CARs requirements;

(g) where management functions have been assigned pursuant to section 573.04 of the CARs:

(i) the name or title of any person to whom functions have been assigned;

(ii) a description of the functions that have been assigned to each person;

(iii) where necessary for clarity, a chart depicting the distribution of functions.

(h) where the organization uses standards for the performance of work that are equivalent to those recommended by the manufacturer, the identification of those additional standards, developed pursuant to subsection 571.02(1) of the CARs;

(i) procedures to ensure that regulatory information and technical data appropriate to the work performed are used, as required by section 571.02 of the CARs;

(j) details of the methods used to record the work performed and ensure that any defects are recorded in the technical record established pursuant to sections 605.92 and 605.93 of the CARs;

(k) details of the system used to maintain and retain records of the work performed for each aeronautical product maintained as described in section 573.15 of this standard;
(amended 2003/06/01)

(l) a detailed description of the system used to ensure that all maintenance tasks, applicable to the work requested of the AMO, have been completed as required by subsection 573.08(4) of the CARs;
(amended 2003/06/01)

(m) a detailed description of the quality assurance program required by section 573.09 of the CARs;
(amended 2003/06/01)

(n) procedures used for incoming inspection and storage of parts and materials to ensure conformity with the requirements of section 571.13 of the CARs. In the case of an undocumented part, prior to being recertified, that part shall be evaluated pursuant to the process set out in Appendix H of Standard 571;
(amended 2003/06/01)

(o) the identity of each person authorized to sign a maintenance release pursuant to section 573.05 of the CARs;
(amended 2003/06/01)

Information Note:

Once the system to authorize ACAs or SCAs is detailed in the MPM, the identification of individual signatories can be established through a list that is incorporated by reference in the MPM.

(p) a description of the methods used to ensure compliance with the personnel qualification and training requirements of subsection 571.02(3) of the CARs;
(amended 2003/06/01)

(q) details of the nature and scope of the work undertaken, in respect of the application made pursuant to section 573.01 of the CARs;
(amended 2003/06/01)

(r) a description of the methods used to ensure that the persons authorized to sign maintenance releases are qualified in accordance with the requirements that are applicable to maintenance performed pursuant to section 573.05 of the CARs;
(amended 2003/06/01)

Information Note:

Incorporation by reference within the MPM is permitted, as long as the "top copy" or controlling reference lists the locations of the incorporated information.

(s) a description of the training program required pursuant to section 573.06 of the CARs;
(amended 2003/06/01)

(t) a description of the personnel records to be retained pursuant to section 573.07 of the CARs;
(amended 2003/06/01)

(u) identification of the level of work which can be performed at each facility, pursuant to subsection 573.08(2) of the CARs, and where the facility is leased, the times at which the facility is available to the lessee;
(amended 2003/06/01)

(v) details of the procedures used to approve maintenance arrangements entered into pursuant to section 573.11 of the CARs, and a list of all such arrangements. Where such maintenance arrangements are made, the information provided in the MPM shall include details concerning the assignment of responsibilities for the certification of the work performed, and for the extension of the AMO quality system to address work performed under the arrangement. Where no such arrangements exists, no approval procedures are required.
(amended 2003/06/01)

Information Notes:

(i) Section 573.11 of the CARs requires that details of contracts that the AMO has established for the performance of work outside of its own organization be shown.

(ii) An AMO MPM need not show any details of maintenance contracts with air operators. These contracts need only appear in the air operator's MCM.

(w) procedures used to report service difficulties as required by section 573.12 of the CARs; and
(amended 2003/06/01)

(x) procedures to control the identification of tools and equipment in respect of which servicing, inspection and calibration is required pursuant to subsection 571.02(2) of the CARs.
(amended 2003/06/01)

(2) Some activities of the organization which are subject to frequent change can more effectively be addressed in manuals separate from the MPM thereby avoiding the necessity for frequent amendments for routine changes in the organization. The incorporation by reference provisions of subsection 573.10(3) of the CARs are intended to provide a means for this, allowing the company to make changes without the requirement for Transport Canada approval. Under these provisions, the person designated in accordance with the assignment of management functions provisions is required to ensure that the incorporated manuals, documents or lists continue to comply with the requirements established in the policy contained in the MPM.

(3) Under the provisions of subsection 573.10(3) of the CARs, each person responsible for an incorporated reference shall certify in writing that the referenced manual meets the requirements of the MPM policies established with respect to that reference. This shall take the form of a certification statement on the front page of the incorporated document or list. This certification shall be made on initial incorporation of the incorporated document, and on each amendment thereof. Acceptance of the procedure for maintaining the referenced manual(s) will be indicated by approval of the MPM.

(4) The Minister shall approve each page of a MPM in writing. This will normally be done by approving a List of Effective Pages. Alternatively, in the case of manuals containing a small number of pages, approval can be shown on each page.

(5) For use in emergency situations, the provisions of subsection 573.10(4) of the CARs provide a means to authorize an AMO to conduct maintenance outside the policies and procedures contained in the MPM. This can occur for any number of reasons; however, approval must not be granted unless the applicant can demonstrate that safety will not be adversely affected.
(amended 2010/12/30)

(6) Where a MPM no longer meets the requirements of this part, whether through a change in the requirements, a change in the organization or its activities, or through an inadequacy shown to exist by verification inspections conducted under the quality assurance program, or any other reason that affects the manuals conformity to requirements, the certificate holder is responsible to prepare and have approved an amendment to its MPM.

(7) An AMO certificate holder shall make a copy of the MPM, or relevant portions thereof available to each person who performs or certifies work on an aeronautical product. In the case where only a portion of the manual is provided, it shall be sufficiently comprehensive that the person performing the tasks has all relevant

information. For non-scheduled work, temporary copies of the relevant portions of the MPM, or any incorporated reference, can be sent via facsimile transmission.

573.11 *Maintenance Arrangements*

(1) Section 573.11 of the CARs requires that an AMO develop specific approval procedures governing maintenance arrangements entered into by the AMO, and that the procedures be detailed in its MPM. However, where an AMO chooses not to include in its MPM approval procedures in respect of maintenance arrangements, each specific maintenance arrangement entered into by the AMO shall be individually submitted for approval by the Minister.

Information Note:

Nothing in the regulation prevents an AMO from dealing with more than one AMO or from changing established arrangements, provided the new arrangement also meets the requirements of section 573.11 of the CARs.

(2) Where an AMO certificate holder requests that an external agent perform work, the AMO is responsible for specifying the tasks to be performed, and, in addition, when that external agent is not the holder of an AMO certificate, or a foreign equivalent, the AMO is also responsible for the completion and certification of the work under Subpart 571 of the CARs.
(amended 2000/12/01)

(3) For the purposes of this section, where an AMO has a maintenance arrangement for the performance of work with an organization other than an AMO, "direct supervision" means that the person from the AMO tasked with certifying the work personally ensures compliance with section 571.11 of the CARs.
(amended 2000/12/01)

(4) With respect to maintenance performed on an aeronautical product, a maintenance release shall be completed in accordance with section 605.85 of the CARs. It is a declaration that, with respect to the maintenance performed, the performance rules of section 571.02 of the CARs have been complied with, and the applicable standards of airworthiness have been met.

(5) Pursuant to section 573.11 of the CARs, the Minister will issue a Maintenance Specification to an AMO where an AMO has a maintenance arrangement to perform maintenance in Canada for a foreign air operator from a state with which Canada has an airworthiness agreement which specifies that Transport Canada will issue a maintenance specification. The Minister will also issue a maintenance specification to an AMO for a maintenance arragement to perform maintenance in Canada for a foreign air operator from any other state and that state has specifically requested that a maintenance specification be issued to the AMO.

(6) Maintenance Specifications issued by the Minister will confirm that the AMO's maintenance arrangement approval procedures contained in its MPM meet the requirements of Standard 573, or that a specific and singular maintenance arrangement is approved by the Minister.

Information Note:

For the purpose of determining if a state is a party to an agreement with Canada, as outlined in paragraph 573.11(1)(b) of the CARs, and to establish whether an agreement applies in a particular case, it may be necessary to obtain a copy of TP8910 from the Chief, Programs Division, Aircraft Certification Branch, Ottawa, Ontario, Canada, K1A 0N8.
(amended 1998/06/01)

573.12 ***Reserved***
(amended 2009/12/01)

573.13 ***Foreign Approvals***

(1) The issuance of a foreign AMO approval, or its renewal, shall only take place where there is an application from the foreign organization seeking a Canadian approval. Applications shall not be accepted from, nor a certificate issued to, a foreign maintenance organization which is only seeking potential or future Canadian customers.

(2) Further to paragraph 573.11(1)(b) of the CARs, AMO approvals shall not be granted in respect of foreign organizations having their facility located in a state with whom Canada has entered into an agreement that provides for recognition of such work.

(3) The certification of maintenance conducted in a foreign location shall normally be met by the extension of a Canadian AMO approval to include a foreign base, or by entering into a mantenance arrangement for such services with organizations located in a state with whom Canada has entered into an agreement that provides for recognition of such work.

(4) All applications made in respect of an organization whose facilities are wholly located outside of Canada shall be supported by documentation demonstrating that the interest of Canada will be served by the issuance of the certificate. Examples of situations that are considered within the public interest are:

(a) where no other practical alternative exists, such as in the case where, due to local regulation, a state will not allow the extension of a Canadian AMO approval;

(b) where the nature of the work is such that the expertise to perform the work is not available in Canada, or in a state with whom Canada has entered into an agreement that provides for recognition of such work.

Information Note:

It is incumbent on the applicant to show that granting a Foreign AMO Certificate is in the public interest, not merely in the interest of the applicant alone. Due to the financial implications placed on the Minister in respect to the issuance and surveillance of foreign AMO certificates, they will only be issued in rare cases.

573.14 *Approved Maintenance Organization (AMO) Identification*

Information Note:

Section 573.14 of the CARs does not preclude the advertisement by the AMO of services which are not co vered by its certificate. However, the advertisement must clearly indicate that any services not covered under the AMO approval are not approved services; approved and unapproved services cannot be mixed or appear in the same list.

573.15 *Technical Records*

(amended 2003/06/01)

(1) The records required by section 573.15 of the CARs include:

(a) aircraft inspection check records containing the maintenance release certifications;

(b) records of any corrective actions raised during scheduled maintenance;

(c) work records in respect of engines, propellers, appliances and components repairs and overhaul;

(d) ground and flight test records; and

(e) copies of the pertinent aircraft technical records indicating:

(i) work in respect of airworthiness directives and any other instructions for continuing airworthiness; and

(ii) maintenance releases applicable to the work performed.

Information Notes:

(i) The "pertinent aircraft technical records" mentioned in paragraph (1)(e) above consist of the aircraft technical records, required pursuant to section 605.92, where the required scheduled maintenance is indicated and the ensuing maintenance releases are recorded by the AMO. Given that these records must be handed over to the aircraft owner following completion of the maintenance, the provisions of section 573.15 of the CARs are needed to maintain traceability within the AMO in respect of its quality assurance program and its MPM requirements pursuant to sections 573.09 and 573.10 of the CARs respectively.

(ii) The other maintenance records mentioned in subsection (1) are those that list all the activities that comprise the performance of scheduled maintenance, including corrective actions peculiar to the performance of this maintenance. As a rule, these work cards, inspection sheets, etc. are not handed over to the aircraft owner since the maintenance releases applicable to the required scheduled maintenance is recorded in the relevant technical records required by section 605.92, and is sufficient to satisfy the requirements of section 571.03 of the CARs.

(2) If the record keeping system relies upon electronic data, it shall include provisions to ensure that:

(a) access (other than "read only" access) is limited to authorized personnel whose duty requires them to modify records;

(b) all entries are made by authorized persons;

(c) once the records are saved, corrections and revisions can be made by authorized personnel only;

(d) the system provides that when changes to established records are necessary, they are made in such a manner that the reason for the change and the identity of the person making the change are recorded, and the original information remains available; and

(e) back up copies be made and kept in a secure location to prevent loss of data.

Transport Canada Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

STANDARD 591
- SERVICE DIFFICULTY REPORTING
- DELETED
(2009/12/01)

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa, Ontario
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51/15-591-2009E-NOTICE

Transport Canada / Transports Canada

TP 6197 E

CARs

CANADIAN AVIATION REGULATIONS

PART V - AIRWORTHINESS

STANDARD 593 - AIRWORTHINESS DIRECTIVES - DELETED (2009/12/01)

Canada

Available through your local bookseller or by mail from
Publishing and Depository Services
Public Works and Government Services Canada
Ottawa, Ontario
KIA OS5

Telephone: 613-941-5995
Orders only: 1-800-635-7943 (Canada and U.S.A.)
Fax: 613-954-5779 or 1-800-565-7757 (Canada and U.S.A.)

Internet: publications.gc.ca

Catalogue No.: T51/15-593-2009E-NOTICE